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DEPARTMENT OF DEFENSE NUCLEAR/BIOLOGICAL/CHEMICAL (NBC) DEFENSE

ANNUAL REPORT TO CONGRESS MARCH 1997

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Cover photo: "*Gas...Gas...Gas*": A soldier hastily dons his protective mask after an NBC attack literally brings him to his knees. The attack was part of a unit expert field medical badge course conducted near Camp Humphreys, Korea.
Photo Credit: taken by Sgt. Matthew H. Sterling, U.S. Army, which received honorable mention in the 1996 Military Photographer of the Year Competition.

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EXECUTIVE SUMMARY

NUCLEAR, BIOLOGICAL, AND CHEMICAL DEFENSE

ANNUAL REPORT TO CONGRESS

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EXECUTIVE SUMMARY

The National Defense Authorization Act for Fiscal Year 1994, Public Law No. 103-160, Section 1703 (50 USC 1522), mandates the consolidation of all Department of Defense chemical and biological (CB) defense programs. As part of this consolidation, the Secretary of Defense is directed to submit an assessment and a description of plans to improve readiness to survive, fight and win in a nuclear, biological and chemical (NBC) contaminated environment. This report contains modernization plan summaries that highlight the Department's approach to improve current NBC defense equipment and resolve current shortcomings in the program.

50 USC 1522 has been a critical tool for ensuring the elimination of redundant programs, focusing funds on program priorities, and enhancing readiness. While many problems remain in consolidating the NBC defense program, significant and measurable progress has been made in fulfilling the letter and the intent of Congress.*

There has been a consolidation of the research, development and acquisition organizations for NBC defense, including the consolidation of all research, development, test and evaluation, and procurement funds for NBC defense. There has been significant progress in the development of Joint training, doctrine development, and requirements generation. Modernization and technology plans have been developed that will begin to show real savings and true consolidation of efforts among the Services. The fruits of these plans will be realized over the next few years as the public law has time to take effect and will result in the increased readiness of U.S. forces.

The objective of the Department of Defense (DoD) NBC defense program is to enable our forces to survive, fight, and win in NBC warfare environments. Numerous rapidly changing factors continually influence the program and its management. These factors include declining DoD resources, planning for warfighting support to numerous regional threat contingencies, the evolving geopolitical environment resulting from the breakup of the Soviet Union, the forthcoming entry into force of the Chemical Weapons Convention, and continuing proliferation of NBC weapons. To minimize the impact of use of NBC weapons on our forces, we will need the capability not only to deter their use, but also to prevent it. This will require improved NBC defensive capabilities. The DoD NBC defense program continues to work towards increasing the defensive capabilities of Joint Forces to survive and continue the mission during conflicts which involve the use of NBC weapons. NBC defense programs are managed jointly under the oversight of a single office within DoD. However, the unique physical, toxicological, destructive and other properties of each threat requires operational and technological responses tailored to the threat.

For our forces to survive, fight and win in an NBC contaminated environment, an integrated and balanced program is essential. Our forces must have aggressive, realistic training,

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* 50 USC 1522 was amended by the FY97 National Defense Authorization Act (Public Law 104-201, Section 228). In accordance with this change, chemical and biological defense programs conducted by the Defense Advanced Research Projects Agency (DARPA) will exist under separate program elements beginning in FY98 and will not be addressed under the CB defense program management and oversight structure described in Chapter 1 of this report. An overview of DARPA's programs is provided in Chapter 2.

and defensive equipment that allows them to avoid contamination, if possible, and to protect, decontaminate, and sustain operations throughout the non-linear battlespace. We must also have the capability to provide medical casualty management. Programs are in place to equip and train our forces to accomplish their missions in an NBC environment. The goal of the program is to equip U.S. forces with the finest available equipment for conducting its missions in the face of NBC threats from potential adversaries around the world.

NBC WARFARE THREAT

The Former Soviet Union's large chemical weapons stockpile and its biological weapons program formed the basis for U.S. defense planning for many years. However, with changes within Eastern Europe, the Middle East and Southwest Asia, the number of countries that have an NBC weapons capability has increased significantly and may continue to increase and pose serious threats to United States interests. The NBC warfare threat has increased in diversity and frequency. Several Third World nations now possess the technologies and capabilities to produce and deliver nuclear (including radiological) and a wide range of chemical and biological agents. The potential for facing NBC conditions in all regions, including those with temperature extremes, has dramatically increased. In meeting this changing and evolving threat, a strong NBC defense program is an essential part of DoD strategy for countering the proliferation of weapons of mass destruction.

NBC WARFARE INTELLIGENCE REQUIREMENTS

Proliferation of weapons technology, precision navigation technology, nuclear (medical, power, and industrial applications) and chemical and biological technology to developing nations presents the United States with a complicated national security challenge. Intelligence efforts must emphasize collection and analysis of nations' "dual-use" nuclear, chemical and biological industrial capabilities and develop the indications and warning of adversarial use of dual-use capabilities. Tailored intelligence documents are essential for developing and updating requirements for NBC defense programs.

NBC DEFENSE PROGRAM MANAGEMENT

Improved Management Structure

In response to Congressional direction, the Department of Defense has implemented an improved management structure for the DoD NBC defense program. In February 1994, the Secretary of Defense designated the Assistant to the Secretary of Defense for Nuclear and Chemical and Biological Defense Programs, ATSD(NCB), as the focal point for NBC defense within the Office of the Secretary of Defense (OSD). In addition, the Secretary appointed the Army as the Executive Agent for DoD to coordinate and integrate research, development, test,

evaluation, acquisition, and military construction requirements of the military departments for the NBC defense program.

Specific plans to coordinate and integrate the Services' NBC defense efforts are stated in the Joint Service Agreement (JSA) for Joint Nuclear, Biological and Chemical Defense Management. DoD implemented the JSA on August 2, 1994. Detailed procedures of coordination and integration of NBC defense efforts are contained in the DoD Chemical and Biological Defense Program Management Plan signed September 16, 1996.

The Deputy Assistant to the Secretary of Defense for Chemical and Biological Matters, DATSD(CBM), is a deputy to ATSD(NCB) and is responsible for the overall coordination and integration of all CB defense research, development, and acquisition (RDA) efforts. DATSD(CBM) provides the overall guidance for planning, programming, budgeting, and executing the CB defense program. He also retains approval authority for all planning, programming, and budgeting documents. He is responsible for ensuring coordination between the medical programs and the non-medical CB defense efforts.

The Secretary of the Army is the Executive Agent responsible for ensuring coordination, integration, and administrative support for the Services' NBC defense requirements and programs. For non-medical CBD, the Secretary of the Army accomplishes these functions through the Joint NBC Defense Board, as defined in the JSA for Joint NBC Defense, and through the Assistant Secretary of the Army, Research, Development and Acquisition, ASA(RDA). To accomplish the required planning and programming functions, two subordinate joint groups support the Joint NBC Board. The Joint Service Integration Group (JSIG) is responsible for Joint NBC defense requirements, priorities, training, and doctrine. The Joint Service Materiel Group (JSMG) is responsible for coordinating and integrating all NBC defense research, development and acquisition efforts. These two groups perform the planning and programming functions for NBC defense.

For medical NBC defense research programs, the Secretary of the Army provides input through participation in the oversight activities of the ASBREM Committee. The ASBREM Committee in concert with the ASA(RDA) is responsible for ensuring coordination and integration of Services medical CBD programs.

NBC DEFENSE PROGRAM MANAGEMENT ASSESSMENT

➢ **Oversight and management of the DoD NBC defense program continue to improve. It is imperative that the management system produces joint NBC defense requirements and NBC defense equipment that can be used by all forces. Public Law 103-160 (50 USC 1522) has provided a key tool for ensuring a jointly focused NBC defense program. The continued support of Congress and implementation of current plans will continue to improve jointness and readiness.**

Accomplishments

DoD has completed implementation of 50 USC 1522:

– An organizational structure ensuring close and continuous coordination of CB warfare defense and CB medical defense programs.

– The DoD CB Defense Program is fully integrated and coordinated and is based on validated Service requirements generated in response to defined threats.

– Responsibility for the CB Defense Program is vested in a single office in OSD and oversight is conducted using the Defense Acquisition Board (DAB) process.

– DoD has responded to all recommendations provided in the General Accounting Office (GAO) report NSIAD-96-103. DoD-planned actions in response to the GAO report were provided to the GAO in a letter from the ATSD(NCB), dated 11 October 1996, Subject: Follow-up on GAO Report NSIAD-96-103 (OSD Case 1099), "Chemical and Biological Defense: Emphasis Remains Insufficient to Resolve Continuing Problems" March 29, 1996.

– A key DoD action in response to the GAO report was the development of an immunization program for biological warfare defense. As executive agent, the Army developed alternative vaccine immunization plans. The alternative plans were coordinated with the Joint Staff and the Services for a decision by the Deputy Secretary of Defense. The Defense Resources Board reviewed the immunization plan in December 1996.

Continuing Process Improvements

Improvements to the Joint Requirements Document process need to be made in order to shorten the processing time and establish joint standards for other than Major Defense Acquisition Programs. The JSIG has requested that the JCS J-8 include process improvements in the next update to CJCS Memorandum of Policy (MOP 77), Requirements Generation System.

Standardization of a DoD wide equipment funding and acquisition policy is another process improvement being investigated to improve efficiency and economy.

NBC DEFENSE REQUIREMENTS

Continued proliferation of NBC weapons requires that DoD maintain and strengthen our defensive capabilities against such weapons. We continue efforts to prevent the use of mass destruction weapons and make preparations to operate effectively in environments marked by biological, chemical, or radioactive contamination. The three principles of NBC defense—contamination avoidance, protection, and decontamination—provide the framework for formulating program requirements. When doctrinal, training, or organizational solutions (non-

materiel solutions) cannot satisfy warfighting needs, we seek new equipment through the acquisition cycle, leveraging new technology developments to provide the best solutions.

The key to successful implementation of research, development, and acquisition (RDA) strategy is the concept of continuous incremental investment. Our RDA goal is to equip our forces with world class equipment in sufficient quantities, in the shortest possible time, to win decisively, quickly, and with minimum casualties. As authorized under the new Joint Service Agreement for non-medical programs and the ASBREM Committee for medical programs, the Army, as executive agent, coordinates, integrates, and reviews the DoD NBC defense program. The results of these reviews, conducted with all Services participating, are documented in the Joint Service Modernization and Joint Service RDA Plans. These documents form the basis for the consolidated NBC defense Program Objective Memorandum.

Non-Medical NBC Defense Mission Area Requirements and RDA Summary

Chapter 2 provides requirements and RDA program summaries for each of the principles of NBC defense. Contamination avoidance consists of three essential elements: early warning, point detection, and warning and reporting. Early warning enables U.S. forces to avoid NBC contamination or to assume the optimal protective posture. Detector development is the cornerstone for this area. The program is pursuing technological advances in remote detection, miniaturization, increased sensitivity, decreased false alarm rates, and improved logistics supportability. Biological detection capability has the highest priority.

When contamination cannot be avoided and units are forced to occupy or traverse contaminated areas, protection provides survivability and continued operational capability in the NBC environment. Individual protection equipment includes protective masks and clothing. Technological advances are being pursued to produce mask systems fully compatible with vision and weapons' sighting systems. Individual protective ensembles are being developed to improve protection, decrease heat and weight stress, and to ensure integration with laser, ballistic and other forms of individual protection. Collective protection equipment includes shelters for command posts, rest and relief, vehicular collective protection, and safe zones aboard ship. Technological improvements will reduce weight and size and increase filter lifetime to improve deployability. Technological improvements that reduce logistical and manpower requirements, *e.g.*, filter change frequency and shelter assembly and disassembly time, are also being pursued.

When contamination cannot be avoided, forces must decontaminate personnel and equipment to reduce or eliminate contamination hazards. While effective against a wide variety of threat agents, existing decontaminant systems are corrosive, labor intensive, and pose logistical, environmental, and safety burdens. To improve decontamination capabilities, the program places emphasis upon new decontamination technologies which reduce existing manpower and logistics requirements, are less corrosive, and which may be used to decontaminate sensitive equipment such as avionics or electronics.

➢ **Advanced technologies and new methods are currently being examined for fixed facility decontamination. Follow-up investigations are planned over the next year to determine the requirements necessary to perform decontamination of large areas, including cleaning areas to sustain cargo handling operations. Over the past year, the Services have worked together to improve the Joint orientation of NBC defense requirements. The work being accomplished will improve the equipment fielded in the near future. More emphasis needs to be placed on the Warfighting Commanders-in-Chiefs' (CINCs) requirements as input for equipment research and development. This is necessary to ensure that future equipment meets the needs of the Joint battlespace environment.**

Areas of concern that are addressed under the management improvement initiatives include the following:

- Focusing and prioritizing chemical and biological detector programs to ensure that resources are leveraging the most promising technologies and are not diluted by excessive Service unique requirements.

- Developing advanced individual protection ensembles that minimally degrade an individual's performance for all tasks performed in contaminated environments.

- Determining adequacy of funding for advanced decontamination systems, reviewing requirements for large scale decontamination systems, and allocating sufficient funds to define requirements for large area decontamination.

- Identifying requirements for collective protection programs to ensure that enough assets are available to complete missions in a CB environment.

Medical NBC Defense Requirements

The medical NBC defense research program has three broad goals:

- protect U.S. forces war fighting capabilities during an NBC attack;
- treat casualties to prevent lethality and maximize return to duty; and,
- maintain state-of-the-art research and development efforts to provide timely medical countermeasures.

To meet these three goals, the Army executes three programs. The Medical Chemical Defense Research Program (MCRDP) provides new pretreatments, antidotes, and topical skin protectants for chemical warfare agents, and develops novel therapies for chemical agent casualties. The Medical Biological Defense Research Program (MBDRP) provides medical countermeasures to deter, constrain, and defeat the use of biological threat agents, as well as advanced diagnostic defenses. The Medical Radiological Defense Research Program (MRDRP)

provides effective countermeasures to both short and long-term effects of ionizing radiation and contamination, including advanced methods of determining radiation exposure levels. Finally, improved casualty care practices doctrine will increase the return to duty rate for troops exposed to chemical and biological agents, thus adding to force sustainment.

To effectively protect individuals against biological warfare (BW) agents, the United States must immunize combat forces. Our priorities are to develop new or improved vaccines against validated BW threat agents and increase the vaccine stockpile. Improved nerve agent antidotes and topical skin protectant increase force survivability against chemical threats. Fielding of a radiation antiemetic will allow service members to continue mission operations despite exposure to moderate levels of radiation in nuclear warfare environments.

MEDICAL R&D REQUIREMENTS ASSESSMENT

➢ **DoD lacks FDA-licensed vaccines against BW threat agents.**

SOLUTION: The DoD will award a prime systems contract during FY97 for the acquisition of vaccines, to include advanced development, FDA licensure, production, storage and testing. In addition, DoD will complete an assessment of vaccine requirements and update vaccination policy for U.S. forces in order to define the cost and scope of the program.

➢ **The effects on humans resulting from the exposure to low doses of chemical agents, particularly organophosphate (nerve) agents, are not clearly understood.**

SOLUTION: Beginning in FY96, DoD, in association with the Research Working Group of the Interagency Persian Gulf Veterans' Coordinating Board, dedicated $5 million to evaluate the chronic effects of low-dose level exposure to chemical agents. Additional funds have been committed for similar and follow-on research in FY97. Studies will address both vesicants as well as nerve agents. Funds will be used to evaluate effects of chemical agents potentially related to chronic health complaints, and for epidemiological projects aimed at identifying health consequences in military personnel potentially exposed to chemical agents.

➢ **The effects on humans of low-level radiation, contamination fields, radiogenic munitions, *i.e.*, depleted uranium, and their interactions with chemical and biological weapons have not been evaluated. All preliminary data indicates a high probability that interactions will result in markedly increased numbers of casualties.**

SOLUTION: Definitive assessment of NBC threat interactions and NBC agent modeling will support the strategic design and development of specific preventative and treatment countermeasures.

NBC LOGISTICAL READINESS

Since OPERATION DESERT SHIELD/STORM, the logistical readiness of NBC defense equipment has improved. Services have increased stockage of most NBC defense equipment items especially individual protection items. However, shortfalls in the accountability and management of chemical and biological defense items continue and affect readiness and sustainment. In addition, industrial base strategy for NBC defense items remains unstable. Through joint efforts, the Services are actively pursuing solutions to these shortfalls.

Although Congress moved to make NBC defense more "joint" through the passage of Public Law 103-160 in 1993, only research, development and procurement programs have benefited through the creation of a joint DoD funding lines. While fielded NBC defense equipment is expected to be joint, the transition of moving from service-unique logistics management to joint logistics management has only just begun. As a result of sustainment management and funding remaining the responsibility of the individual Services, the overall logistics status of the DoD NBC defense program is not as joint as the research and development process.

NBC defense is not a high priority in peacetime, and spending to maintain the inventory to meet the two major regional contingency (MRC) scenario requirements has been dropping for years. Serious readiness and sustainment issues exist, many of which were highlighted in the March 1996 GAO report. Units throughout DoD are short end-items, consumables, and parts needed for initial deployment as a result of other priorities of procurement and operations and maintenance (O&M) funding. War reserve inventories are at a level that industrial surge-production cannot make up the shortages of many NBC defense end items and consumables within the Defense Planning Guidance timeframe. These facts govern the DoD NBC defense program environment. If the Services face another MRC with an imminent NBC threat, such as DESERT STORM, the demand for NBC defense equipment will be urgent.

While problems remain, joint aspects of the DoD NBC defense program continue to grow. The successful completion of the FY98-03 POM Strategy demonstrated the Services' commitment to coordinating their requirements and funding. The Joint Service Lightweight Integrated Suit Technology (JSLIST) has incorporated joint logistics and procurement to deliver standardized protective ensembles for all Services. The XM22 Automatic Chemical Agent Detector/Alarm (ACADA), jointly developed by the Air Force and Army, shows good promise to become one of the first truly joint (cradle to grave) NBC defense items. Tri-Service medical NBC programs are very closely coordinated in the logistics area, representing a goal toward which non-medical NBC programs aspire.

NBC Defense Equipment Availability

The logistics community has recognized several shortfalls in the accountability and management of NBC defense item inventories. *First*, the Services continue to have very limited

asset visibility of most chemical and biological items below the wholesale level. *Second*, Services procure consumable NBC items through multiple, separate and distinct funding authorizations.

Industrial Base

Since OPERATION DESERT SHIELD/STORM, DoD has completed several industrial base assessments. These studies confirm that the NBC defense industrial base sector primarily consists of small to medium size companies. These companies depend heavily on military requirements and sales for their survival. Recent changes in the NBC threat, as well as reductions in overall DoD NBC defense requirements have had a severe impact on this sector making it extremely fragile. DoD's "War Stopper" program currently aids in sustaining this base for some selected systems—battle dress overgarment, chemical gloves, and nerve agent auto-injectors. The Services must continue to integrate the vulnerability of the industrial base into acquisition and procurement decisions in order to maintain a responsive industrial base.

LOGISTICS SUPPORT ASSESSMENT

➢ **DoD lacks a joint, integrated system to maintain asset visibility of NBC defense equipment below wholesale level, and lacks a standardized war reserve program for NBC defense equipment. Resourcing the procurement and sustainment of wartime stocks of individual protective equipment, decontamination kits, and detector kits remains the responsibility of the Services.**

***SOLUTION*:** DoD established the requirement for asset visibility and reviewed existing systems and procedures, both for peacetime reporting and war time reporting. The Services and the Defense Logistics Agency are addressing the NBC defense asset visibility deficiency under the auspices of the Total Asset Visibility initiative.

During 1997 all four Services are participating in development of the JCHEMRATES IV study which will provide a more accurate prediction of the initial issue and sustainment quantities required for each Service than previous studies. Results of this effort should be available for inclusion in next year's Annual Report to Congress.* The use of this common methodology will allow the presentation of Joint Service requirements in future reports and facilitate improved joint logistics management.

In November 1996, the JSMG completed a *Joint Service Nuclear, Biological and Chemical Defense Logistics Support Plan.* The plan outlines proposed short-, mid-, and long-term strategies to resolve and overcome many of the problems facing NBC defense equipment readiness and sustainment. The vision for the long-term is to develop a partnership of medical and non-medical NBC defense items in all Services with industry to improve the coordination and management of development, production, and stockpiling/sustaining of NBC defense equipment. The Department continues to pursue innovative strategies to maintain a responsive industrial base, especially those strategies

* Joint Chemical Defense Equipment Consumption Rates

that decrease industry reliance on DoD procurement for industrial base survival. Strategies may include tapping into to independent research and development (IR&D) conducted by universities and corporations, increasing reliance on dual-use technologies, and pursuing strategies that will encourage companies to decrease dependency on DoD requirements for their survival.

NBC DEFENSE TRAINING AND READINESS

NBC defense training and readiness continues to be a critical element of deterrence. The Services continued to improve the exercising of their NBC defense responsibilities under Title X of the FY94 National Defense Authorization Act. The vision for the future is to build on the Service successes to develop a viable joint orientation to NBC defense capabilities. This capability must include joint doctrine and tactics, techniques, and procedures; joint modeling, simulation and wargaming; and joint professional training.

Joint Doctrine for Nuclear, Biological, and Chemical (NBC) Defense (Joint Pub 3-11) is the cornerstone Joint doctrinal manual. This document provides an overview of NBC defense operations at the strategic level. To fully implement this doctrine, the Services must develop solid operational joint NBC defense doctrine and tactics, techniques, and procedures that integrate Service operations in the battlespace.

Each of the Services has established adequate training standards and programs to sustain unit NBC training and readiness. They conduct NBC defense training at schools and in units. In compliance with Public Law 103-160, Section 1703, the Services NBC defense professional training schools are co-located at the U.S. Army Chemical School, Ft McClellan, Alabama. Currently, Services conduct their own training with their own instructors, but all use the Chemical Defense Training Facility at the Army's Fort McClellan, Alabama, to train NBC defense experts and leaders in a lethal agent environment.

NBC DEFENSE TRAINING AND READINESS ASSESSMENT

➢ **DoD lacks a mechanism to provide adequate information on the current status of training, equipment, and readiness. It needs adequate information to assess operational force capabilities from the Department and the warfighting CINCs' perspectives.**

***SOLUTION*:** Assign consistent and higher priority to NBC defense, especially by the Joint Chiefs of Staff and the warfighting CINCs, in order to maintain an adequate state of readiness and to ensure NBC defense reporting information is accomplished in a timely and adequate manner. Existing reporting systems may provide an adequate mechanism for assessing readiness.

➢ **Joint NBC defense doctrine needs to be continually developed and include joint tactics, techniques, and procedures.**

***SOLUTION*:** Initiatives began in 1987 to develop joint NBC defense doctrine which resulted in Joint Pub 3-11, *Joint Doctrine for Nuclear, Biological, and Chemical (NBC) Defense*. In FY95 efforts were initiated to update this document. The Joint Service Integration Group is responsible for assisting the Services in the development of this doctrine under sponsorship of the Joint Staff. Continued Service interaction and cooperation facilitated by these organizations will produce the next generation of Joint NBC Defense Doctrine.

➢ **There are limited chemical and biological features in wargaming and planning models.**

SOLUTION: Funding to add chemical and biological warfare to exercise scenarios has been received for FY96. Efforts are underway in the current DoD programming cycle to establish long term support. The CB Modeling Process Action Team is also addressing this issue.

CHEMICAL WEAPONS CONVENTION ISSUES

DoD has set up a functional Implementation Working Group (IWG) to plan for the implementation of the Chemical Weapons Convention (CWC) and related chemical weapons agreements. Through regularly recurring meetings, representatives of OSD, the Joint Staff, the Military Services, and DoD agencies and activities plan and coordinate to ensure successful implementation of the CWC and related bilateral CW agreements.

OSD, the Joint Staff, the Military Services, On-Site Inspection Agency (OSIA) and the Defense Special Weapons Agency (DSWA) provide technical experts to support activity at the CWC Preparatory Commission (PrepCom) in The Hague, The Netherlands on a recurring basis. The PrepCom is charged with developing procedures and establishing the international forum, the Organization for the Prohibition of Chemical Weapons (OPCW), which will oversee international compliance with the CWC. These activities focus on all requirements of the CWC, including those outlined in Article X of the CWC, "Assistance and Protection Against Chemical Weapons."

The Military Services and the OSIA have developed individual, detailed implementation plans to provide guidance for their commands and activities under the CWC and the related agreements. As outlined in their individual plans, the Services and OSIA have conducted assistance visits and formal exercises to ensure that all elements are prepared to comply with the agreements.

In accordance with the DoD Master Program Plan for Research, Development, Test and Evaluation for Arms Control, DSWA directs the DoD research and development effort to ensure the arms control verification proceeds using the most effective technology available.

CONCLUSION

The DoD NBC defense program has made significant progress in improving the coordination and integration of Service NBC defense research, development, and acquisition (RDA). The community is now better prepared to address shortcomings which still exist in our NBC defensive posture. The established RDA program will resolve many shortcomings by executing current procurement plans and adapting available technologies. Funding constraints will delay modernization and could effect training realism. For programs which demand state-of-the-art solutions, the Department must demonstrate a continued commitment of time and resources. Together with improved joint management initiatives, proactive programs, and stable and balanced funding, U.S. capabilities and readiness will continue to improve into the future.

INTRODUCTION

NUCLEAR, BIOLOGICAL, AND CHEMICAL DEFENSE

ANNUAL REPORT TO CONGRESS

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I. PURPOSE

This report provides Congress with an assessment of the overall readiness of the Armed Forces to fight in a nuclear, biological, and chemical (NBC) warfare environment in accordance with 50 USC 1523. This is the fourth report submitted under 50 USC 1523.*

The Department of Defense (DoD) NBC defense program objective is to enable our forces to survive, fight and win in NBC contaminated environments. Numerous rapidly changing factors are continually influencing the program and its management. These factors include a new defense strategy, an era of declining DoD resources to include force structure reductions, planning for warfighting support to numerous regional threat contingencies, the aftermath of the breakup of the Soviet Union, the signing and forthcoming entry into force of the Chemical Weapons Convention (CWC), and continued proliferation of weapons of mass destruction (WMD).

The President's February 1996 Report, *A National Security Strategy of Engagement and Enlargement,* outlines the three central components of the administration's strategy as "(1) our efforts to enhance our security by maintaining a strong defense capability and employing effective diplomacy to promote cooperative security measures; (2) our work to open foreign markets and spur global economic growth; and (3) our promotion of democracy abroad." U.S. military capabilities are critical to the success of this strategy. United States forces must be capable of deploying rapidly and being able to respond to a variety of tasks. One of these tasks is to counter WMD—nuclear, biological and chemical weapons—along with their delivery systems, which pose a major threat to our nation's security. The response to the threat of NBC weapons must be based on the nature of this threat, not just where the threat occurs. Thus, a key part of the Department of Defense's strategy is to seek to stem the proliferation of such weapons and to develop an effective capability to deal with these threats. To optimize the response to the threat, DoD and the intelligence community have completed several classified reports over the past year providing threat assessments focusing on chemical and biological threats to U.S. forces. To minimize the impact of use of WMD on our forces, we need the capability to deter their use. This will require improved WMD defensive capabilities. The DoD NBC defense program continues to work towards increasing the capabilities of Joint Forces to survive and continue the mission during conflicts which involve the use of WMD.

The DoD NBC defense program continues to invest in future technology to provide improved capabilities with minimal adverse impact on our war fighting potential. Our goal is to improve our Forces' capability to detect NBC agents which facilitates the ability to avoid them. Smaller, lighter protection; decontamination systems with reduced logistical burden; an integrated, balanced system of force protection; and medical casualty care and management are necessary to sustain operational tempo on a nonlinear battlefield. Sound doctrine and realistic training remain fundamental to our defense against WMD.

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* The text of 50 USC 1523, *Annual report on chemical and biological warfare defense*, (implemented as part of Public Law 103-160, the FY94 National Defense Authorization Act) is included at the end of this section.

II. THREAT ASSESSMENT

Nuclear Weapons Threat: The threat posed to the United States and its allies by the proliferation of nuclear weapons is real and growing. While there is no current, direct Inter-Continental Ballistic Missile (ICBM) threat against the United States by nations other than Russia and China, the threat from theater ballistic missiles is of growing concern. More than two dozen countries have operational ballistic missiles, and more have programs in place to develop them. North Korea has sold Syria and Iran extended-range Scud Cs and has apparently agreed to sell missiles to Libya. Egypt, Israel, and Pakistan are developing and producing missiles, and several Persian Gulf states have purchased whole systems as well as production technology from China and North Korea. Some have equipped these missiles with WMD, and others are striving to do so.

In a more recent, and perhaps more dangerous development, North Korea has developed and tested an indigenous ballistic missile with a range of about 1,000 kilometers. This missile is capable of carrying the full range of WMD, including nuclear weapons. North Korea's continued efforts to sell the missile abroad—particularly to dangerous and potential hostile countries such as Iran—is of greatest concern. With this missile, North Korea could reach Japan; Iran could reach Israel, and Libya could reach US bases and allied capitals in the Mediterranean region.

Two countries that could engage in warfare using nuclear weapons are India and Pakistan. Both nations have nuclear weapon development programs. Other areas such as the Mid-East and Far-East have the potential for similar action. The nuclear threat posed by North Korea is of major concern not only to South Korea and Japan but also to China. Nuclear weapons in the hands of North Koreans leaders can destabilize the entire region. However, things can change rapidly. As long as nations perceive nuclear weapons as enhancing their security, and others are willing to sell the technology, required production equipment, or finished weapons, the threat from nuclear proliferation will grow.

Chemical and Biological Weapons Threat

Currently there are dozens of countries with known or suspected chemical and biological weapons programs. Some of these are relics from the Cold War, others are the result of current tensions and instabilities, and still others defy explanation based on our concepts of logic and decision making. However, whatever the rationale for the existence of these programs, they nonetheless will pose threats of varying degrees to the military forces of the United States when operating in these countries. Further, those countries which are of the greatest concern to the United States regarding proliferation are in regions in which the United States has well-defined national security interests. It is therefore especially important that we continue to maintain a credible capability to operate effectively in a CBW contaminated environment in executing military operations.

Protecting against expected or actual chemical and biological warfare attacks can make it difficult to carry out military missions because protective measures restrict vision, add weight, and increase heat stress. Further logistic burdens are added by the need for decontamination chemicals and equipment, detection gear, and specialized reconnaissance devices and vehicles.

Threatened or actual use of chemical and biological warfare places significant stress on troop morale.

Future scenarios for chemical and biological warfare use against engaged forces are not expected to differ from those envisioned historically in conjunction with the large-scale chemical and biological warfare programs that a number of countries have pursued. Of the targets listed below, those in the first category tend to be most susceptible to infectious agents, which have a relatively slow onset of effect but larger area coverage. Targets in the second and third categories are vulnerable to a wide variety of chemical and biological agents. The targets in the fourth category are most susceptible to chemical and toxin agents, which have a relatively rapid onset of effect but smaller area coverage per unit weight of agent.

I. High-value, large-area facilities/targets within or outside of theater: leadership, diplomatic, military headquarters, industrial, commercial, population centers.

II. Theater support military facilities: command and control, troop barracks, air bases, missile launch sites, naval ports, logistical transfer/storage facilities.

III. Military assets near engagement areas: troop convoys, staging areas, drop zones, air strips, air defense systems, artillery support bases, naval task forces.

IV. Forces in engagement: infantry, amphibious, mechanized/armor.

Chemical and biological weapons known to have been designed in conjunction with offensive programs have taken a wide variety of forms. Probable means of weapons employment are summarized below.

- Off-target (upwind) attacks using agent aerosol disseminators moved along paths perpendicular to wind direction. Means of delivery could be aircraft, UAVs, cruise missiles, boats/submersibles, or ground vehicles. Such attacks also could be achieved with multiple source detonation/spray devices covertly emplaced upwind from the target and triggered remotely or by timing devices.

- On-target attacks using various forms of agent containing fused munitions that explosively disseminate or spray agent at or near ground level. Among these munitions are ballistic and cruise missile warheads, aircraft ordnance, tube and rocket artillery, and naval gunfire.

- Area-denial attack using persistent (generally chemical) agents laid down in a heavy pattern with the intention of contaminating ground areas and water-crossing points that enemy forces may attempt to traverse. Means of delivery include aircraft ordnance, artillery, and mines.

Aimed at certain critical nodes in the military infrastructure of the United States, either domestically or abroad, chemical or biological weapons could disrupt the execution of military

objectives. Therefore, it is imperative that the United States have an ability to operate effectively in a contaminated environment while simultaneously being able to identify threat agent(s), treat injured personnel, and remediate the contaminated area.

Another less well understood threat in the realm of chemical warfare or terrorism is the potential for a Bhopal-like event resulting from deliberate targeting of industry or commerce in population centers. A current example of this is found in the operations in Bosnia. Chemical plants in Bosnia, some even around Tuzla, are designed to produce large quantities of chemicals for the manufacture of common products, such as plastics. During WWI, some of these chemicals were used as warfare agents. These chemicals, such as phosgene and chlorine, have become staples of the modern chemical industry; yet their potential for use during conflict is as great today as ever. Moreover, the political situation and the restraints on the use of such non-specific weapons, restraints which have precluded their use in warfare among the industrialized nations over the past 80 years, are missing in these regions of ethnic and religious conflict.

United States forces which have to operate in these regions face, therefore, the combined threats of both conventional chemical agents and weapons and the potential for exposure to chemicals produced as an element of the regions chemical industry. Scale of operation is the main discriminator between military uses of weapons and chemicals released from chemical plants by saboteurs or collateral damage resulting from military operations. The chemical plant at Tuzla is a prime example; the chemical storage tanks there have a capacity to hold over 2 times as much chlorine as was released by Germany in their first ever chemical attack, which killed or injured over 5,000 people in a span of just 15 minutes. If released in an area like Tuzla, such a catastrophic release could have a significant effect on military operations, as well as affecting future humanitarian, political, and economic considerations at all levels ranging from local to international.

Chemical and Biological Weapons Proliferation

International efforts to stem chemical and biological weapons proliferation have focused on attempts to control exports by suppliers, through cooperative multinational efforts such as the Australia Group, and on prohibitive national laws and other actions undertaken in conjunction with the objectives of the Chemical Weapons Convention and the Biological Weapons Convention. Embargoes on chemical and biological warfare-related equipment and materials generally have impeded but not stopped chemical and biological weapons proliferation. Experience has shown that restraints on suppliers often can be circumvented because equipment and materials employed in producing chemical and biological warfare agents are dual use. Suppliers and purchasers frequently assert that they are involved with legitimate defensive research activities. Covert transactions are another common means of facilitating proliferation.

The threat of proliferation of chemical and biological weapons is as great as it has ever been, and the prospects are bleak for controlling this form of warfare in third world regions where demographics, religious and ethnic, and economic conflicts continue to boil over into both guerrilla and open warfare. In regions such as the Middle East, the pressures to have a military response to potential military actions is a powerful driver towards both chemical and biological warfare. The costs of nuclear weapons, the requirement for large supporting infrastructures, and the acquisition of many

different technologies to support a single program are highly limiting factors in the spread of nuclear weapons. Conversely, the only requirement for effective production of chemical agents is a rather baseline chemical process industry; biological agents production can be adequately supported in a country with a variety of pharmaceutical, veterinary, or medical establishments, assuming the political will and cooperation of the scientists and engineers to do so. The effectiveness of weaponization of these weapons will depend on the overall support which the military provides and the training and doctrine development which they undertake, however with only modest investments a credible and effective program can be established, even if it is held as a clandestine program which is largely isolated from the mainstream of a country's military.

The proliferation of knowledge and technology world wide is a growing concern as it relates to the issues of chemical and biological agents and weapons. Ready access to the emerging international network of computer databases and communications provides a would be proliferent in this area with unparalleled access to information which can greatly accelerate a program. Further, the ability to communicate in an unhindered way with people involved in development of such programs throughout the world accelerates programs by providing means for the rapid elimination of unproductive avenues of investigation, thereby saving time and money.

The former Soviet Union (FSU) may have had the most advanced chemical and biological weapons program in the world; at the very least, they certainly had the largest. The collapse of the Soviet Union and the current problems of employment in the resulting republics may have significant impact in the coming years on the direction and pace of development of chemical and biological weapons programs throughout the world. While not necessarily sanctioned by the standing governments of the FSU, individuals and organizations may find themselves obliged to sell their knowledge and products for hard currency just to survive. Certainly the scientists and engineers formerly employed in the FSU CBW programs are believed to be in dire straights, with the only commodity which they can sell for income being their knowledge of the production and weaponization of chemical agents.

The availability of assistance from Russia and possibly other sources is likely to influence the biological warfare threat for years to come. Nations wishing to upgrade their biological warfare programs or become biological warfare-capable without reliance on traditional agents may well have the option of purchasing rather than developing the pertinent technology.

Open press reporting of the chemical agents which the FSU developed suggests that these chemicals may be much harder to detect, protect against, and treat exposures to, than the current nerve agents which have been the main threat to American forces for several decades, and which are the standards to which our programs have been designed. Proliferation of these new agents to regions of political and economic instability such as the Middle East, could pose threats to U.S. national interests in ways which we are inadequately prepared to respond. With much of the developed world operating in the Middle East and depending on open lines of communications for their economic survival, the United States may become embroiled in any hostile actions threatening those lines of communications. The prospect of facing a country, such as Iraq, equipped not just with chemical weapons, but chemical weapons for which we do not possess adequate means of detection or

protection may deter or delay military operations by the United States in order to protect U.S. national interests.

Another proliferation problem is fringe groups which may or may not be aligned with other states and/or political or religious organizations. The prime example of both is the *Aum Shinrikyo* Cult in Japan—fringe in that they did not represent any main stream religion or political group, yet religious in their belief system and organization. Intending to disrupt and planning to replace the existing government, they operated on a world wide scale, visiting Russian and other FSU republics, as well as the United States. They were extremely well funded and in a span of only a couple of years accomplished what some countries have strived to do over decades. They made use of advanced technologies, commuter networks, and international travel to acquire, assemble, and operate production facilities for the sole purpose of making chemical and biological weapons.

Recently, there have been cases of individuals obtaining seed cultures of bacteriological organisms, which have enormous potential for infecting large populations. Others have been found to be acquiring toxins, such as ricin which is extracted from the castor oil bean, again for reasons of terrorism. It is unlikely that all such attempts will be discovered or intercepted, however there is no doubt that they would have a major disruptive effect on the daily execution of business and commerce in the United States, and as such represents a serious threat to our national security.

NBC WARFARE INTELLIGENCE REQUIREMENTS

Nations with CBW capabilities are increasing. Proliferation of weapons technology, precision navigation technology, nuclear (medical, power, and industrial applications) and chemical and biological technology to developing nations presents the United States with a complicated national security challenge. Intelligence efforts must emphasize collection and analysis of nations' "dual-use" nuclear, chemical and biological industrial capabilities and develop the indications and warning of adversarial use of dual-use capabilities. Tailored intelligence documents are essential for developing and updating requirements for CB defense programs. Numerous threat documents tailored to the CB threat have been produced and are updated continually. The Intelligence Community should conduct a national review of chemical and biological warfare intelligence requirements and assess the adequacy of current assets to execute the required intelligence program.

III. OVERVIEW OF CONTENTS

- *Chapter 1* describes measures taken to improve the overall joint management and coordination of the NBC defense program.

- *Chapter 2* provides non-medical NBC defense requirements and research and development programs information. Requirements and the status of research and development assessments are described within the framework of the functional areas of NBC defense.

- *Chapter 3* provides medical NBC defense requirements and research and development information. Medical technologies preserve combat effectiveness by timely provision of medical countermeasures in response to Joint Service NBC defense requirements. Both requirements and the status of research and development are examined in detail.

- *Chapter 4* provides an analysis of NBC defense logistics posture. The analysis reviews the status of quantities, characteristics, and capabilities of all fielded NBC defense equipment; industrial base requirements; procurement schedules; and problems encountered.

- *Chapter 5* assesses the status of NBC defense training and readiness conducted by the Services. Each of the Services training standards and programs is reviewed.

- *Chapter 6* provides information on the planning and preparations by the Department of Defense for implementation of the Chemical Weapons Convention.

- Annexes provide detailed information on all Joint and Service unique NBC defense equipment.

  In previous reports, two additional annexes were included that are not present in this report. The first of these provided an Annual Report to Congress on Research, Development, Test and Evaluation (RDT&E) conducted by the Department of Army for the Purpose of Medical Biological Defense. (This report was required by Section 2370, U.S. Code 10.) The requirement for this report was repealed by Congress by the FY96 National Defense Authorization Act. The second report is still required though submitted separately to Congress. This report provides the Department of Defense, Annual Report to Congress on the Research, Development, Test and Evaluation of the Chemical/Biological Defense Program for the previous fiscal year. This report is a Section 1511, U.S. Code 50 requirement. This information is reported to Congress in the "R-forms" for NBC Defense (RDT&E program description forms) provided to Congress on an annual basis. One of the successes of the DoD NBC Defense Program has been the consolidation of all DoD NBC Defense RDT&E program funds under six program elements, rather than throughout numerous Service accounts. A summary of funds expended by the DoD NBC Defense Program is shown at Annex E.

TEXT OF PUBLIC LAW MANDATING REPORT ON THE DEPARTMENT OF DEFENSE CHEMICAL AND BIOLOGICAL DEFENSE PROGRAM

Title 50 of the U.S. Code, Sec. 1523. Annual report on chemical and biological warfare defense
Implemented by Public Law 103-160, The FY94 National Defense Authorization Act

(a) Report required

The Secretary of Defense shall include in the annual report of the Secretary under section 113(c) of title 10, a report on chemical and biological warfare defense. The report shall assess--

(1) the overall readiness of the Armed Forces to fight in a chemical-biological warfare environment and shall describe steps taken and planned to be taken to improve such readiness; and

(2) requirements for the chemical and biological warfare defense program, including requirements for training, detection, and protective equipment, for medical prophylaxis, and for treatment of casualties resulting from use of chemical or biological weapons.

(b) Matters to be included

The report shall include information on the following:

(1) The quantities, characteristics, and capabilities of fielded chemical and biological defense equipment to meet wartime and peacetime requirements for support of the Armed Forces, including individual protective items.

(2) The status of research and development programs, and acquisition programs, for required improvements in chemical and biological defense equipment and medical treatment, including an assessment of the ability of the Department of Defense and the industrial base to meet those requirements.

(3) Measures taken to ensure the integration of requirements for chemical and biological defense equipment and material among the Armed Forces.

(4) The status of nuclear, biological, and chemical (NBC) warfare defense training and readiness among the Armed Forces and measures being taken to include realistic nuclear, biological, and chemical warfare simulations in war games, battle simulations, and training exercises.

(5) Measures taken to improve overall management and coordination of the chemical and biological defense program.

(6) Problems encountered in the chemical and biological warfare defense program during the past year and recommended solutions to those problems for which additional resources or actions by the Congress are required.

(7) A description of the chemical warfare defense preparations that have been and are being undertaken by the Department of Defense to address needs which may arise under article X of the Chemical Weapons Convention.

(8) A summary of other preparations undertaken by the Department of Defense and the On-Site Inspection Agency to prepare for and to assist in the implementation of the convention, including activities such as training for inspectors, preparation of defense installations for inspections under the convention using the Defense Treaty Inspection Readiness Program, provision of chemical weapons detection equipment, and assistance in the safe transportation, storage, and destruction of chemical weapons in other signatory nations to the convention.

CHAPTER 1

NBC DEFENSE MANAGEMENT

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1.1 MANAGEMENT IMPLEMENTATION EFFORTS

During FY96, the Department of Defense (DoD) completed the process to consolidate, coordinate, and integrate the chemical and biological (CB) defense requirements of all Services into a single DoD CB Defense Program. Additionally, DoD completed the final steps to ensure close and continuous coordination between the Chemical Biological Warfare Defense program and the Medical Chemical Biological Defense program.

1.1.1 Management Reviews

DoD has continued to use the Defense Acquisition Board (DAB) process to conduct oversight of the consolidated CB defense program. Integrated product team working groups and overarching integrated product team meetings are conducted throughout the process to review progress concerning current actions, discuss new management issues, and develop recommendations for DAB decision.

As part of the Program Objectives Memorandum (POM) development process, the OSD Director for Program Analysis and Evaluation conducted a major front end assessment of DoD counterproliferation programs, including CB defense. The Defense Resources Board (DRB) reviewed and approved the results of the assessments. A Program Decision Memorandum incorporated the DRB decisions into the development of the FY98 budget request.

1.1.2 Technology Base Review and Assessment

The Assistant to the Secretary of Defense for Nuclear and Chemical and Biological Defense Programs, ATSD(NCB), in coordination with the Director, Defense Research & Engineering (DDR&E), provides technical oversight of all Service and Defense Agency science and technology base (S&T) programs and reviews these programs at least annually. An independent technology area review and assessment (TARA) of the DoD CB Defense S&T program was conducted in FY96.

By March of each year, DoD prepares three key documents detailing S&T efforts—the Joint Warfighting S&T Plan (JWSTP), the Defense Technology Area Plan (DTAP), and the Basic Research Plan (BRP). Along with Reliance Briefings[1], these plans provide critical input for the CB Defense TARA. These plans are published in time to be cited in the Defense Planning Guidance to guide Defense Agency and Service preparation of their S&T budgets and programming efforts. Copies of these plans are to be submitted to Congress separately beginning in FY97 in accordance with public law. Figure 1-1 illustrates the process by which plans and assessments provide the basis for budget requests and effective program execution.

[1] Defense Reliance, through its Executive Committee (EXCOM), oversees the work of ten Defense Technology Area Panels. Each panel is responsible for a specific technology area. The Technology Area Panel membership consists of Service and appropriate Defense agency technical specialists and is chaired by a senior Service S&T manager.

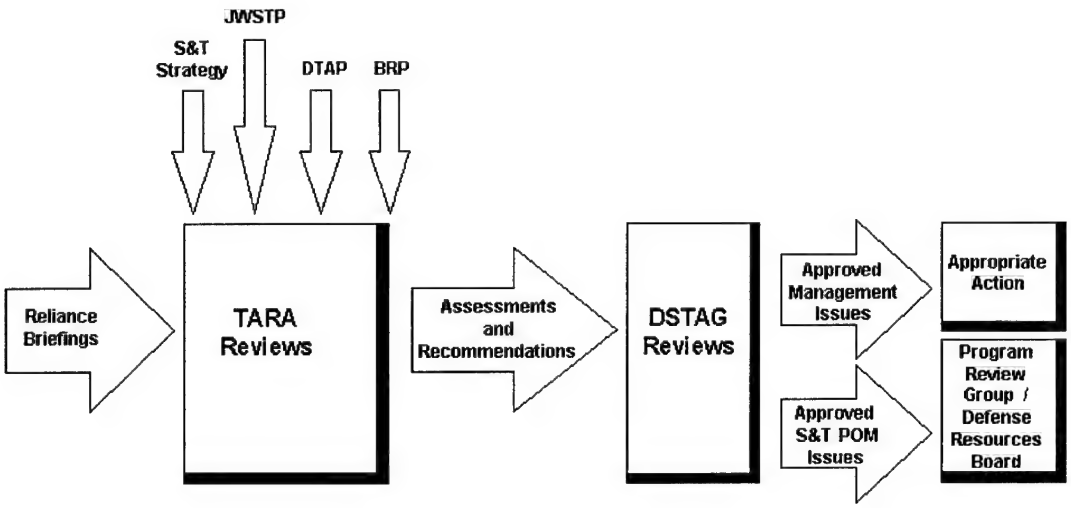


Figure 1-1. Technology Area Review and Assessment (TARA) Process in Context

These plans ensure that the near-, mid-, and far-term needs of the joint warfighter are properly balanced and supported in the S&T planning, programming, budgeting, and assessment activities. Advanced concepts and technology identified as enhancing high priority joint warfighting capabilities, along with prerequisite research, receive funding priority in the President's Budget and accompanying Future Years Defense Plan (FYDP). These plans are made available to the United States Government, Defense contractors, and our allies with the goal of better focusing our collective efforts on superior joint warfare capabilities and improving interoperability between the United States and our allies.

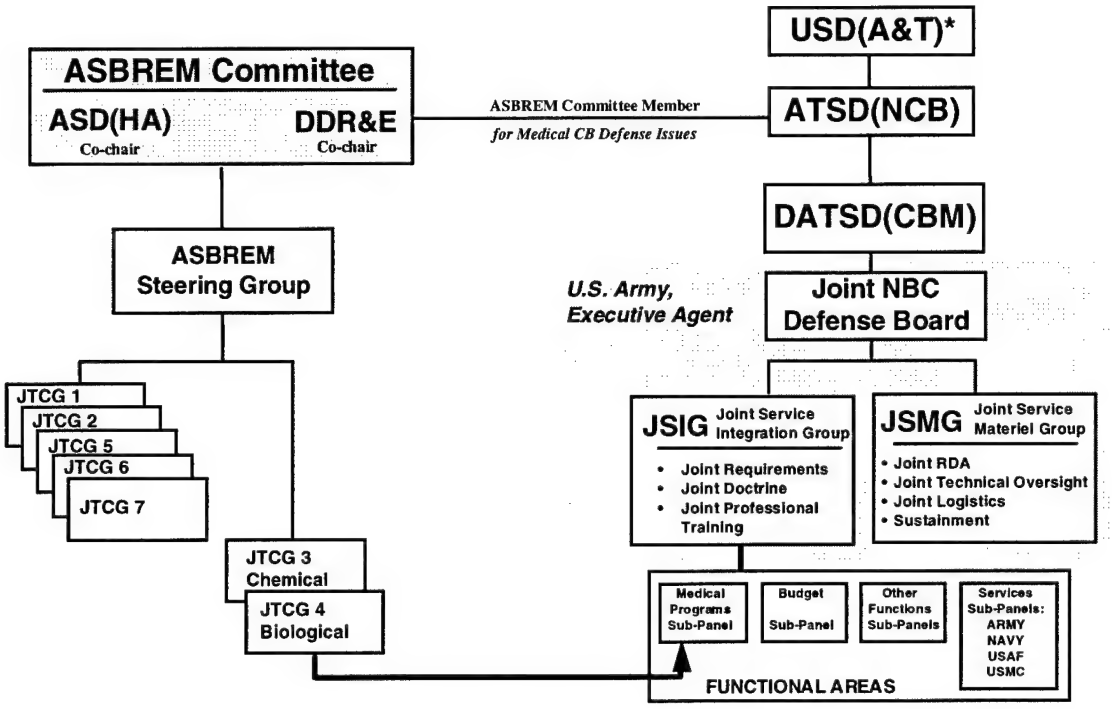
Following the TARA, the DoD co-chair of the TARA briefs the findings and recommendations to the Defense S&T Advisory Group (DSTAG). Included in this brief are the co-chair's program recommendations for termination, adjustment and enhancement to better align the S&T program to comply with guidance. Following the DSTAG briefings, issues are briefed to the Program Review Group and Program Decision Memoranda are issued as needed.

1.1.3 Coordination and Integration of the Program

Through the Joint Service Agreement on NBC Defense, the Military Services have established a viable structure which ensures that Service operational needs are integrated and coordinated from their inception and that duplication of effort is eliminated from NBC defense research, development, and acquisition. The series of reviews conducted by the Joint Service Integration Group and the Joint Service Materiel Group, both separately and together, have proved to form the appropriate organizational method to accomplish the coordinating and integrating function.

1.2 ORGANIZATIONAL RELATIONSHIPS

The overall CB defense program management structure, portrayed in Figure 1-2, helps facilitate coordination and integration of the program. This management and oversight structure was developed late in 1996 to provide integration of medical and non-medical CB defense efforts at the Service level. Integration of CB defense efforts will continue in 1997.



ASBREM - Armed Service Biomedical Research Evaluation and Management
ASD(HA) - Assistant Secretary of Defense for Health Affairs
ATSD((NCB) - Assistant to the Secretary of Defense for Nuclear and Chemical and Biological Defense Programs
DATSD(CBM) - Deputy Assistant to the Secretary of Defense for Chemical and Biological Matters
DDR&E - Director, Defense Research and Engineering
JTCG - Joint Technical Coordinating Group
USD(A&T) - Under Secretary of Defense for Acquisition and Technology
*USD(A&T) serves as the chairman of the Defense Acquisition Board

Figure 1-2. Chemical and Biological Defense Program Management Structure

The OSD single office responsible for oversight of the DoD CB Defense program is ATSD(NCB). ATSD(NCB) promulgated the DoD CB Defense Program Management Plan which specifies the relationships and responsibilities among the coordinating agencies.

ATSD(NCB) provides the fiscal and programming guidance to the Joint NBC Defense Board to develop the POM. The Joint NBC Defense Board issues POM Preparation Instructions to the subordinate groups which review the validated requirements and build the POM strategy recommendations. The CB Defense Program is divided into the following commodity areas: contamination avoidance, individual protection, collective protection, decontamination, medical chemical defense, and medical biological defense. These commodity areas correspond to the projects under the budget program elements. There is also a program budget element to support program management and oversight in accordance with the Joint

Service Agreement and in compliance with 50 USC 1522. The JSMG and the Armed Services Biomedical Research Evaluation and Management (ASBREM) steering group each ensure that the program risk is mitigated across commodity areas, and the ongoing efforts are complementary but not duplicative.

Over the past year, a Medical Program Sub-Panel (MPSP) was created as part of the JSIG (as indicated in Figure 1-2). The MPSP will be headed by the AMEDDC&S, in accordance with current practices. However, it will be the responsibility of the Army, as the Executive Agent for the Joint NBC Defense Board, in consultation with the JSIG staff, AMEDDC&S, and other interested organizations, to determine and implement optimal arrangements for executing integration of MPSP into the JSIG. The purpose of this panel is to identify medical program needs and requirements as developed by the AMEDDC&S, CINCs, Services, Joint Staff, the ASBREM Committee, and other users. The MPSP will have the primary responsibility for prioritizing medical CB defense requirements. The users as well as Joint Technology Coordinating Group (JTCG) 3 (MCDRP) and JTCG 4 (MBDRP) will provide input of medical requirements (separate from non-medical requirements) to the MPSP. The MPSP will coordinate, integrate, and prioritize all of the user requirements input. It will provide the consolidated, integrated, and prioritized list of medical CB defense requirements to the JSIG. The JSIG will submit the medical requirements list along with the non-medical requirements list to the JNBCDB. The JSIG may provide comments but will make no changes to the list when submitting the medical requirements to the JNBCDB. The JNBCDB and DATSD(CBM) may make changes to the medical or the non-medical requirements and priorities list.

The Deputy Assistant to the Secretary of Defense for Chemical and Biological Matters, DATSD(CBM), is a deputy to ATSD(NCB) and is responsible for the overall coordination and integration of all CB defense research, development, and acquisition (RDA) efforts. DATSD(CBM) provides the overall guidance for planning, programming, budgeting, and executing the CB defense program. He also retains approval authority for all planning, programming, and budgeting documents. He is responsible for ensuring coordination between the medical programs and the non-medical CB defense efforts.

The Secretary of the Army is the Executive Agent responsible for coordination, integration, execution and administrative support for all Services' CB defense requirements and programs. The Secretary has delegated this responsibility to the Assistant Secretary of the Army for Research, Development and Acquisition, ASA(RDA), who also co-chairs the Joint NBC Defense Board. The military departments' acquisition organizations execute the individual CB defense programs according to Service and DoD directives.

The CB Defense Program is developed by the Services using the structure shown in Figure 1-3.

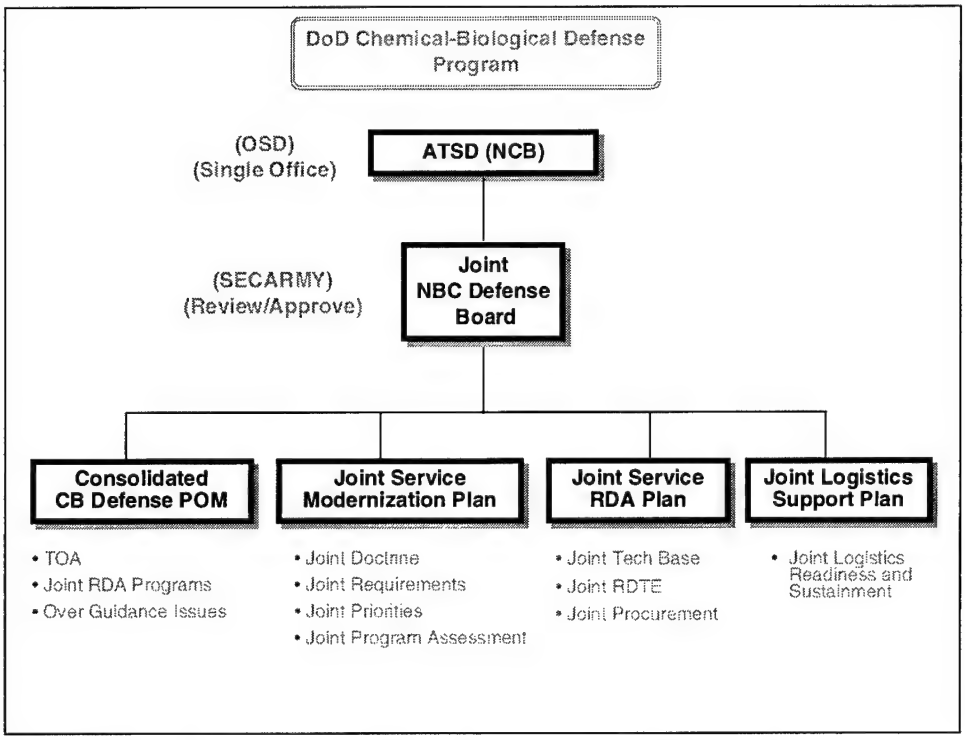


Figure 1-3. Chemical and Biological Defense Program Development

Each document is the product of a coordinated and integrated effort and includes all Services, medical, and Joint staff input and results in a comprehensive reflection of the overall DoD CB Defense Program.

1.3 FUNDS MANAGEMENT

Figure 1-4 describes the funds management process for the CB defense program and the coordination between funding and executing organizations. The key organizations in this process are: DATSD(CBM) as the OSD focal point; the JNBCDB Secretariat representing the Executive Agent; the Ballistic Missile Defense Office (BMDO) as the funds manager; the JSMG as coordinator and interface between the participating organizations; and the operating agencies and performers which execute the programs. For budget distribution, the JNBCDB Secretariat provides funds distribution information to DATSD(CBM) based on the appropriated budget. The DATSD(CBM) prepares funds suballocation instructions and submits them to the BMDO to distribute the funds to the operating agencies.

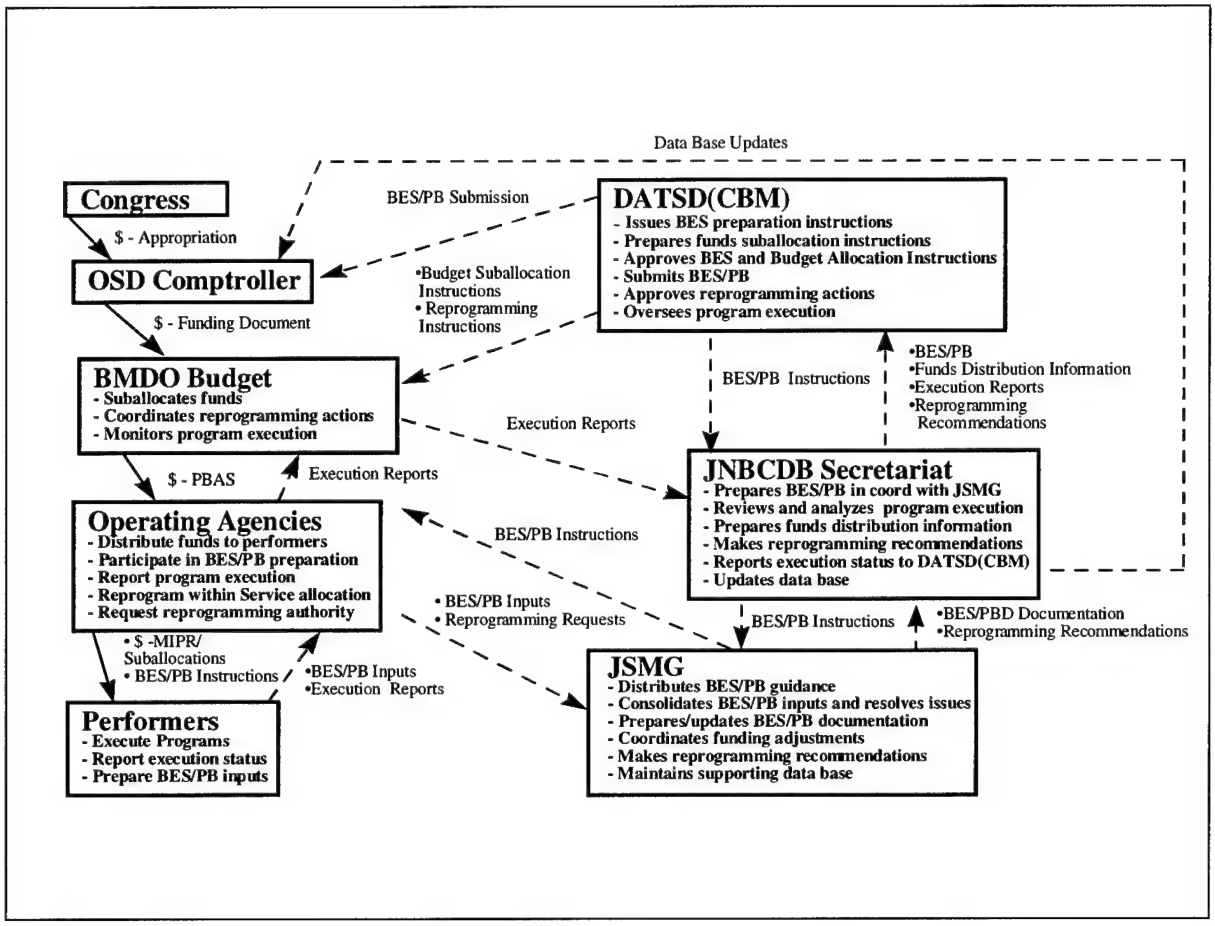


Figure 1-4. Chemical and Biological Defense Funds Management Process

The lead components or operating agencies provide notification of all funding adjustments to the JSMG Executive Office. The JSMG Executive Office, in turn notifies the other components/agencies and the JNBCDB Secretariat (to update the database). For minor adjustments other than reprogramming actions, this is the only necessary action. Lead components have authority to reprogram funds within projects for which they are responsible, but all other reprogramming actions require prior DATSD(CBM) approval. The JSMG Executive Office forwards to the JNBCDB Secretariat the reprogramming requests with recommendations and any concerns raised by the other components and operating agencies. The JNBCDB Secretariat reviews the reprogramming actions and forwards them with recommendations to DATSD(CBM). Once approved, DATSD(CBM) authorizes BMDO to execute the reprogramming. During the execution year for medical programs, the Headquarters, U.S. Army Medical Research and Materiel Command (USAMRMC) staffs all actions resulting from the requirement to reallocate funds between the Services.

BMDO and DATSD(CBM), in coordination with the JNBCDB Secretariat, issue execution and program status reporting instructions. The lead components report execution status to BMDO on a monthly basis. BMDO forwards all reports to the JNBCDB Secretariat for analysis. The JNBCDB Secretariat reports execution status to DATSD(CBM) on a

quarterly basis. It is the JNBCDB Secretariat's responsibility to notify the DATSD(CBM) when programs deviate from or are in danger of not meeting obligation and execution goals.

BMDO serves as the funds manager for the CB Defense program. They issue funding documents, per DATSD(CBM) direction, and perform all required accounting functions, with the assistance of the Army staff which represents the Executive Agent. The JNBCDB Secretariat updates the OSD comptroller databases as necessary after the POM, Budget Estimate Submission (BES), and President's Budget (PB). DATSD(CBM) ensures that the JNBCDB Secretariat is kept informed of all OSD comptroller guidance, directives, and schedules.

1.4 NBC DEFENSE PROGRAM MANAGEMENT ASSESSMENT

➢ **Oversight and management of the DoD NBC defense program continue to improve. It is imperative that the management system produces joint NBC defense requirements and NBC defense equipment that can be used by all forces. Public Law 103-160 (50 USC 1522) has provided a key tool for ensuring a jointly focused NBC defense program. The continued support of Congress and implementation of current plans will continue to improve jointness and readiness.**

1.4.1 Accomplishments

DoD has completed implementation of 50 USC 1522:

– An organizational structure ensuring close and continuous coordination of CB warfare defense and CB medical defense programs.

– The DoD CB Defense Program is fully integrated and coordinated and is based on validated Service requirements generated in response to defined threats.

– Responsibility for the CB Defense Program is vested in a single office in OSD and oversight is conducted using the DAB process.

– DoD has responded to all recommendations provided in the General Accounting Office (GAO) report NSIAD-96-103. DoD-planned actions in response to the GAO report were provided to the GAO in a letter from the ATSD(NCB), dated 11 October 1996, Subject: Follow-up on GAO Report NSIAD-96-103 (OSD Case 1099), "Chemical and Biological Defense: Emphasis Remains Insufficient to Resolve Continuing Problems" March 29, 1996.

– A key DoD action in response to the GAO report was the development of an immunization program for biological warfare defense. As executive agent, the Army, developed alternative vaccine immunization plans. The alternative plans were coordinated with the Joint Staff and the Services for a decision by the Deputy Secretary of Defense. The Defense Resources Board reviewed the immunization plan in December 1996.

1.4.2 Continuing Process Improvements

Improvements to the Joint Requirements Document process need to be made in order to shorten the processing time and establish joint standards for other than Major Defense Acquisition Programs. The JSIG has requested that the JCS J-8 include process improvements in the next update to CJCS Memorandum of Policy (MOP 77), Requirements Generation System.

Standardization of a DoD wide equipment funding and acquisition policy is another process improvement being investigated to improve efficiency and economy.

CHAPTER 2

NON-MEDICAL NUCLEAR, BIOLOGICAL, AND CHEMICAL WARFARE DEFENSE REQUIREMENTS AND RESEARCH AND DEVELOPMENT PROGRAM STATUS

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2.1 INTRODUCTION

This chapter provides a consolidation of Joint Service non-medical NBC defense requirements and an assessment of these programs to meet the needs of the Force. The discussion of both requirements and the status of research and development assessments is conducted within the framework of the three principles of NBC defense doctrine for the mission area, shown in Table 2-1.

Table 2-1. Principles of Chemical and Biological Defense Doctrine

• **Contamination Avoidance**
• **Protection**
• **Decontamination**

Continued proliferation of NBC weapons creates a continuous need to ensure that U.S. forces can survive, fight, and win in an NBC threat environment. The ever increasing danger from these weapons demands that we look for every opportunity to avoid technological surprises. When doctrinal, training, or organizational solutions (non-materiel solutions) cannot be found, new equipment solutions are sought through the materiel acquisition cycle. The evolving operational requirements demand that the Joint forces progressively capture and leverage advances in technology to provide the best in NBC defense equipment for the forces. We must continue to build upon the fundamentals of NBC defense doctrine.

As defined in Joint Pub 3-11, *Joint Doctrine for Nuclear, Biological, and Chemical Defense,* contamination avoidance includes detecting, avoiding, and bypassing contaminated areas. Protection consists of individual and collective protection. Decontamination restores combat power.

The key to the successful implementation of research, development, and acquisition (RDA) strategy is the concept of continuous incremental investment. Our RDA goal is to equip the Force with world-class equipment in sufficient quantities and in the shortest time possible in order to win decisively, quickly, and with minimal casualties. As authorized under the Joint Service Agreement for non-medical programs and Armed Services Biomedical Research, Evaluation and Management (ASBREM) Committee for medical programs, the Army as executive agent coordinates, integrates, and reviews the DoD NBC defense program. The results of these reviews, conducted with all Services participating, are documented in the Joint Service Modernization and Joint Service RDA Plans. These documents form the basis for the consolidated NBC defense Program Objective Memorandum (POM).

The Services in coordination with the Commanders-in-Chief (CINCs) decide if a materiel solution is needed to solve the requirement through the process of requirement identification and analyses. If a valid requirement exists, then the research and development modernization process will identify improved technology approaches which may provide a new system or upgrade an existing system. Continuous modernization is the strategy used to sustain and

enhance the capabilities of our forces within our acquisition system—personnel, industrial base, infrastructure, and programs.

In accordance with our national strategy of achieving and applying technological superiority, several underlying concepts form the foundation of acquisition modernization. The first is the need to reduce cycle time in the acquisition of new systems or the integration of emerging technologies into existing systems. The use of Advanced Concept Technology Demonstrations (ACTDs), open systems and architectures, along with the new emphasis on commercial standards and practices, allow us to shorten the acquisition cycle time. Our programs must reduce the overall cost by using concepts such as design-to-cost and concurrent engineering to ensure that equipment is easy to maintain and repair even with the inherent complexity seen in the majority of new systems.

2.2 NBC DEFENSE MISSION AREA REQUIREMENTS AND RDA SUMMARY

Over the past two years, the Services have been working closely to increase the jointness in ongoing programs. This report highlights improvements during FY96 and discusses cooperative efforts for further Joint development of requirements. This section is a summary of the requirements in each of the mission area tenets. Tables 2-2 through 2-10 provide a consolidation of requirements and acquisition strategies. Since the focus of this chapter is on research and development efforts, fielded items are not included in these tables. Descriptions of fielded equipment can be found in annexes A–D at the end of this report.

2.3 CONTAMINATION AVOIDANCE (Detection, Identification and Warning)

NBC reconnaissance, detection, identification, warning and reporting are the essential elements of contamination avoidance. Early warning is the key to avoiding NBC contamination. Sensors for the individual joint task force member and systems capable of detecting multiple agents and characterizing new agents are being developed. Advances in technology are being pursued in chemical and biological standoff, and remote/early warning detection, miniaturization, lower detection limits, logistics supportability and affordability. The following sections detail contamination avoidance science and technology efforts, modernization strategy, and Joint Service programs.

2.3.1 Contamination Avoidance Science and Technology Efforts

2.3.1.1 Goals and Timeframes. The goal of contamination avoidance is to provide near real-time capability to detect, identify, locate, quantify, and warn against all CB warfare agent threats below threshold effects levels (see Table 2-2). Science and technology efforts currently emphasize multi-agent sensors for biological agent detection and remote/early warning CB detection. To meet near-term needs, a number of individual sensors are being developed while detection technology matures. Far-term objective technologies will allow integration of chemical and biological point and remote/early warning detection modules into a single system. The technology focus is on detection sensitivity across the evolving spectrum of CB agents; systems size/weight, range, signature and false alarm rate; and integration of CB detectors into

various platforms, individual clothing, and command, control, communication, computer, and intelligence (C^4I) networks. Detector technologies based on olfactory-like chemical sensing and molecular approaches to optical sensors offer long term opportunities.

Table 2-2. Contamination Avoidance Science and Technology Strategy

By 1997	By 2002	By 2007
• Demonstrate improved chemical standoff detection from ships • Demonstrate improved reconnaissance capability • Joint Chemical Agent Detector (JCAD) downselect between Surface Acoustic Wave and Mini-Ion Mobility Spectroscopy (Mini-IMS)	• Demonstrate integrated point biodetection capability (Advanced Technology Demonstration) • Complete fabrication of tunable, eye safe laser for standoff detection • Field (eye safe) Long Range Bio Stand-off Detector in FY99 or FY00. Schedule may slip depending on possible restructure after Congressional cut. • Complete development of CB water monitor • Complete Air Base / Port Bio Detection ACTD (FY98) • Start Joint Biological Remote/Early Warning System (JBREWS) ACTD in FY98 with fielding of ACTD systems to selected CINCs by FY01	• Demonstrate integration of chemical and biological agent detection modules into a single sensor suite • Field equipment contamination scanner, handheld • Start JBREWS objective system engineering and manufacturing development (EMD) in FY99, with production in FY02, and first unit equipped (FUE) in FY02

2.3.1.2 Potential Payoffs and Transition Opportunities. The future CB detection system will provide the capability to detect, identify, map and track all CB contamination in a theater of operations. This will enable commanders to avoid CB contamination or to assume the appropriate protection required to continue fighting and sustain their mission with minimal performance degradation and casualties. Small, lightweight chemical detectors can be incorporated into clothing ensembles to provide an individual chemical detection capability. CB detection technologies have dual use potential in monitoring air pollution, noxious fumes inside enclosed areas, and municipal water supplies.

2.3.1.3 Major Technical Challenges. The major technical challenges are in the areas of biological detection and identification, including remote/early warning sensing, improved agent discrimination and quantification, sampling efficiency, interferent rejection and genetic probe development. Size reduction of detectors, development of integrated biological and chemical detection systems, and the fusion of sensor data with mapping, imagery and other data for near real-time display of events are other areas of challenge.

2.3.2 Contamination Avoidance Modernization Strategy

The increased lethality and heightened operational tempo of the future battlefield demand responsive NBC detection and warning capabilities in order to reduce force degradation caused by contamination. These capabilities—which also encompass NBC reconnaissance, identification, warning and reporting—have the strongest urgency for force readiness and will

continue to be emphasized by the DoD community in the near and distant future. Table 2-3 shows the roadmap of DoD requirements for contamination avoidance.

Table 2-3. Contamination Avoidance Modernization Strategy

	NEAR (FY97-00)	MID (FY 01-05)	FAR (FY 06-11)
Chemical Point	• **Surface sampling capability (ICAM)** • **Automatic, digital point detection of nerve and blister agents (ACADA)** • Navy-*Ship based improved automatic point detection of nerve/mustard (IPDS)* • Navy-*Automatically detect liquid agent (SALAD)*	• **Improved, all-agent programmable automatic point detection; portable monitor, miniature detectors for aircraft interiors; interior ship spaces; individual soldiers (JCAD)** • **Detection of CB contamination in water (Agent Water Monitor)**	• **Improved surface contamination monitor** • **Low dosage miniature detector; specific identification; personal monitor**
Biological Point	• **Automatic point/mobile biodetection to detect and identify bio-agents; programmable (JBPDS)** • Navy-*Ship based Interim Biological Agent Detector (IBAD)* • Army-*Biological Integrated Detection System (BIDS)*	• **Automatic point biodetection, to detect and identify; programmable (JBPDS Block II)**	• **Automated detection of all validated biological threat agents (Joint Biological Universal Detector, JBUD)**
NBC Reconnaissance and C/B Stand-off Detection	• **Improved NBC Reconnaissance Vehicle with remote/early warning and data infusion capabilities (JSNBCRS)** • Army - *Long Range Stand-off detection and mapping of aerosol clouds (LR-BSDS)*	• **Biological remote detection and early warning capabilities (JBREWS)** • **Lightweight passive stand-off detection for chemical agent vapors (JSLSCAD)** • **Addition of biological detection and identification capabilities (JSNBCRS P3I)** • **Light reconnaissance vehicle (JSLNBCRS)**	• **Mobile stand-off detection, ranging, and mapping of chemical vapors and aerosols (JSCWILD)** • **Wide area detection**
Warning and Reporting	• **Initial automated warning and reporting interoperable with all Services, C4I (JWARN)**	• **Integrated and automatic NBC warning and reporting: mission management (JWARN P3I)**	
Radiac	• Army-*Compact, digital whole body radiation measurement (AN/UDR-13)*		• **Stand-off radiation detection and measurement** • **Portable radiation meter**

1. Joint Service programs are highlighted in **BOLD**; Service unique efforts are *italicized.*
2. Where applicable, systems which meet requirements are listed following the entry.

Early detection and warning is the key to avoiding NBC contamination. As a result, DoD is concentrating RDA efforts on providing its warfighters real-time capabilities to detect, identify, quantify, and warn against all CB warfare threats below threshold effects levels. Real time detection of biological agents "below threshold effects levels" is unlikely; microbial pathogens that can produce productive infections with 1–10 organisms are likely to create effective exposures at the same time the detector "sees" it. Current emphasis is on multi-agent sensors for biological agent detection and early warning detection of chemical and biological agents. To meet the needs of the next three to five years, several stand-alone detectors and

sensors are being developed. As detection technology matures, development efforts will focus on system miniaturization, improved sensitivity and range, and decreased false alarm rate. This focus will facilitate the integration of chemical detectors into personal warfighter gear, chemical and biological detectors onto various air, sea, and ground platforms, and integration of detectors into automated warning and reporting networks. Table 2-4 provides an overview of RDA efforts and Service involvement.

Table 2-4. Contamination Avoidance RDA Efforts

Category	Nomenclature	Status	USA	USAF	USMC	USN
Automatic Detectors and Monitors	- XM22 Automatic Chem Agent Detector (ACADA)	RDTE	Joint	Joint	Joint	Interest
	- Shipboard Liquid Agent Detector (SALAD)	RDTE				Rqmt
	- Improved Point Detection System (IPDS)	Production				Rqmt
	- Improved CAM (ICAM)	Production	Rqmt	Interest	Rqmt	Interest
	- Joint Service Agent Water Monitor (JSAWM)	RDTE	Joint*	Joint*	Joint*	Interest
	- Joint Chemical Agent Detector (JCAD)	RDTE	Joint*	Joint*	Joint*	Joint*
	- Biological Point Detection					
	--Interim Biological Agent Detector (IBAD)	Production				*Rqmt*
	--Biological Integrated Detection System (BIDS NDI)	Fielded	*Rqmt*	*Rqmt*		
	--BIDS P3I	RDTE	*Rqmt*			
	- Joint Bio Point Detection System (JBPDS)	RDTE	Joint	Joint	Joint	Joint
Remote/ Early Warning	- Joint Service Lightweight Stand-off Chemical Agent Detector (JSLSCAD)	RDTE	Joint*	Joint*	Joint*	Joint*
	- Joint Service Chemical Warning and Identification LIDAR Detector (JSCWILD)	RDTE	*Rqmt*	*Rqmt*		
	- Biological Stand-off					
	--Joint Remote Biological Early Warning System (JBREWS)	RDTE	Interest	Interest	Interest	Interest
	--Long Range Bio Stand-off Detection System-NDI (LRBSDS-NDI)	Production	*Rqmt*	*Interest*		*Interest*
	--LRBSDS	RDTE	*Rqmt*	*Interest*		*Interest*
NBC Recon	- Joint Service NBC Reconnaissance System (JSNBCRS)	RDTE				
	--M93A1 NBCRS/CB Mass spectrometer (See BIDS)	*	*Rqmt*		*Rqmt*	
	--Joint Service Light NBCRS/Lightweight Recon System (LNBCRS)	*	Joint*	Joint*	Joint*	*Interest*
Warning and Reporting	- Joint Warning and Reporting Network (JWARN)	RDTE	Joint*	Interest*	Joint*	Joint*
	-- Multipurpose Integrated Chemical Agent Detector (MICAD)	*	*Rqmt*	*Interest*	*Rqmt*	
Radiacs	- AN/UDR-13 Pocket Radiac	Production	Joint	Interest	Joint	

Joint= Joint Service requirement
Rqmt= Service requirement
Rqmt, Interest= sub-product requirement or interest
Joint*=Draft Joint Service requirement
int-NIR= Service interest, no imminent requirement
*= Sub-product(s) of a Joint project

The management challenge involves the coordination and consolidation of dozens of detection and warning RDA efforts across the Services. This strategy, led by the JSMG through the Contamination Avoidance Commodity Area Manager (formerly the Joint Service Detection Working Group), resulted in the initiation of RDA efforts which shared common technical goals, but were constrained to Service unique requirements. Recent management organizations and initiatives, such as the Joint Program Office for Biological Defense (JPO-BD) and the Joint NBC Defense Board are building Joint Service coordination across the mission area.

Over the past four years, JPO-BD has managed several single service and joint biological detection programs. Three single service biodetection programs fielded in the past year, in which JPO-BD has managed include:

- the Navy's Interim Biological Agent Detector (IBAD); 25 detectors are being fielded throughout FY96–97,
- the Army's Biological Integrated Detection System - Non-Developmental Item (BIDS NDI), which has been type classified standard, and fielded to the newly activated (5 Oct 96) 310th Chemical Company,
- and the Army's Long Range Biological Standoff Detection System (LR-BSDS), which has also been type classified standard, and is also being fielded this year to the 310th Chemical Company (3 systems).

Key joint systems JPO-BD manages include:

- The Joint Biological Point Detection System (JBPDS) which enters Engineering and Manufacturing Development (EMD) phase in FY97. The JBPDS will be the first truly joint biological detection acquisition program that is built on an approved Joint Operational Requirements Document (JORD).
- The Air Base/Port Bio Detection Advanced Concept Technology Demonstration (ACTD) which has undergone two major field trials, completed drafting of a Concept of Operations (CONOPS), and will begin limited fielding in FY97.
- The Joint Biological Remote/Early Warning System (JBREWS) ACTD which starts development in FY98. The JBREWS ACTD is also supported by the Counterproliferation Support Program.

Over the past three years, the JSMG and JSIG, through the Contamination Avoidance Commodity Area Manager, with assistance from JPO-BD transformed and consolidated 44 separate contamination avoidance developmental efforts into ten fully coordinated joint projects. Requirements, nomenclature, and program plans for these projects are maturing and will be complete by FY98. The requirements for the Joint Biological Point Detection System were developed by a Joint Service working group, and responsibilities for project execution have been clearly defined by the four Services to maximize their research and development effectiveness and to avoid duplication of effort. The Joint Programs are:

- Automatic Chemical Agent Detector Alarm (ACADA)
- Joint Chemical Agent Detector (JCAD)
- Joint Service Lightweight Standoff Chemical Agent Detector (JSLSCAD)
- Joint Service Chemical Warning and Identification LIDAR Detector (JSCWILD)
- Joint Biological Point Detection System (JBPDS)
- Joint Biological Remote Early Warning System (JBREWS)
- Joint Service NBC Reconnaissance System (JNBCRS)
- Joint Warning and Reporting Network (JWARN)
- Joint Service Agent Water Monitor (JSAWM)

2.3.3 Joint Service Contamination Avoidance Programs

Completing the consolidation of Joint Service contamination avoidance programs has been a primary goal for the past two years. Building upon the success of the prior year, all

detection programs have been restructured to meet current multi-Service needs. Bolded entries in Table 2-3 highlight Joint programs. Detailed descriptions of Joint contamination avoidance programs are at Annex A.

Chemical Warfare Agent Contamination Avoidance

A non-developmental item NDI Automatic Chemical Agent Detector (ACADA) is being purchased for point detection of low level chemical agent vapors. ACADA is suitable for many vehicle-mounted and man-portable applications. The Joint Service Lightweight Standoff Chemical Agent Detector (JSLSCAD) for passive standoff, on-the-move detection of chemical agent vapor is in Phase II (Engineering and Manufacturing Development, EMD) of the acquisition cycle. The core system of JSLSCAD will weigh approximately 13 pounds and occupy approximately 1.3 cubic feet. The system may be modified to accommodate a variety of requirements. To date, a 360° x 60° scanner was developed for Armored Systems Modernization applications (tracked and wheeled vehicles), and the system was integrated into a gimbal for Marine Corps helicopters and unmanned aerial vehicle (UAV) contamination avoidance roles. This system is also being considered by the Navy for shipboard use and by the Air Force for use at air bases.

In the near-term, the four Services are focusing chemical point detection requirements on the Joint Chemical Agent Detector (JCAD), formerly known as the Joint Service Chemical Miniature Agent Detector (JSCMAD). The JCAD will represent a chemical point detection system in order to accomplish a variety of mission requirements on multiple service platforms. This system will be considerably smaller and lighter than the ACADA and can be configured for a variety of applications such as individual soldier detectors, shipboard chemical agent monitoring, special operations forces (SOF) applications, and aircraft interior detection. The JSMG selected the Air Force as lead service for the JCAD. The Army, Air Force, and Marine Corps have also agreed to focus upon the development of a Joint Service Light NBC Reconnaissance System (LNBCRS). The proposed system will consist of a suite of detectors required for a specific mission which could be easily integrated into the platform of choice. Currently two configurations are proposed: a light and a medium version, to fulfill expeditionary and armored mission profiles, respectively. The FOX NBCRS would fulfill heavy requirements. The FOX NBCRS is being upgraded to include a chemical stand-off detection capability and other electronic improvements including data fusion.

In the mid- to far-term, the Army and Air Force have agreed to a Joint Service Chemical Warning and Identification LIDAR Detector (JSCWILD). The JSCWILD is a laser-based standoff detection system being developed to meet the requirements for the detection of chemical liquids, aerosols and vapors. Although this system is much heavier than its passive counterpart (JSLSCAD), it does provide the ability to detect chemical agents in all forms (liquids, vapors, aerosols) as well as mapping and ranging information. The Air Force's primary use for this system will be air base defense. A requirement for an agent water monitor has been identified by the Army, Air Force, and Marines. Joint program plans are being developed.

Biological Warfare Agent Contamination Avoidance

Currently, there are six detection efforts being conducted under the Joint Program Office for Biological Defense (JPO-BD): (a) the Interim Biological Agent Detector (IBAD); (b) the Joint Biological Point Detection System (JBPDS); (c) the Biological Integrated Detection System (BIDS); (d) the Long Range Biological Stand-off Detection System (LR-BSDS); (e) the Air Base/Port Biological Detection Advanced Concept Technology Demonstration (ACTD); and (f) the Joint Biological Remote/Early Warning System (JBREWS) ACTD.

In the near-term, the Joint Bio Point Detection System (JBPDS) will meet each of the four Services' needs for a biological point detector. This system will be integrated on Service designated platforms. IBAD is the Navy's shipboard detection system, while the BIDS is the Army's land based system. The LR-BSDS is a helicopter mounted infrared LIDAR system for the detection, ranging and tracking of aerosol clouds that may indicate a biological warfare (BW) attack. The Air Base/Port Biological Detection ACTD will develop and demonstrate for the first time the capability to protect high value fixed sites against biological warfare attacks.

In the mid-term, the JPO-BD will develop the Joint Biological Remote Early Warning System to gain advanced warning of biological warfare attacks.

JPO-BD's concept for the ultimate, joint service biological detector is the Joint Biological Universal Detector (JBUD). JBUD is envisioned to be a miniaturized, multi-technology, automatic system that may be manned or unmanned, capable of detecting all BW agents, and able to automatically warn troops and report pertinent data relative to a BW attack.

2.3.4 Warning and Reporting

Warning and reporting is a critical issue in contamination avoidance. The Services have agreed to expedite development of this capability by integrating ongoing hardware (MICAD) and software (HAZWARN and ANBACIS) into a Joint Warning and Reporting Network (JWARN). This network will be compatible with, but not duplicate, all C^4I equipment both current and developmental. Initial urgent requirements of software will be fielded. In FY99 a Warning and Reporting Network of hardware and software will be fielded. The system will then be continuously improved to provide increased management and control functions, as well as to integrate features of the emerging Global Command Control System (GCCS).

2.3.5 Other Contamination Avoidance Programs

Various detection and warning requirements have unique mission profiles and technical specifications. While in some instances the development effort may leverage off the technical achievements of a closely related detection and warning project, the application beyond its intended mission is limited and accordingly supports a specific requirement. Starting in first quarter FY97, the Navy is producing the Improved (chemical agent) Point Detection System (IPDS), an upgrade for the existing shipboard Chemical Agent Point Detection System (CAPDS). IPDS, which offers continuous operation and advanced detection sensitivities that do not respond to shipboard interferents, is not adversely affected by the high electromagnetic

environment around ships. IPDS improves detection thresholds, response time, and adds the capability to detect mustard agents. The Navy is also developing the Shipboard Automatic Liquid Agent Detector (SALAD). This shipboard system will be used to automatically detect and alarm in the presence of liquid chemical agents. By detecting automatically, it will minimize the sailor's exposure to contamination. As with the IPDS, it will offer continuous operation and advanced detection sensitivities that do not respond to shipboard interferents and are not affected by naval electromagnetic interference (EMI).

Defense Advanced Research Projects Agency (DARPA) Programs

As one of the major programs conducted under its Defense Science Office, DARPA is pursuing the demonstration and development of biological warfare (BW) defense capabilities. The DARPA BW defense program is developing advanced point detectors for BW agents and extending the combat informatics program to BW defense. The DARPA program is developing detectors with minimal or no false alarms and small size (on an electronic chip) that can be operated unattended. The BW Defense informatics thrust is developing the capability to deliver information to the field medic about BW treatment protocols and to provide BW casualty information to the medical and field commands. In addition, DARPA conducted efforts beginning in FY96, to develop medical BW countermeasures with an emphasis on multi-agent approaches. FY96 efforts included projects demonstrating the feasibility of using modified red blood cells to eliminate pathogens from the blood, and preliminary exploration of approaches for using stem cells as a vehicle for therapeutic use.

2.4 PROTECTION

When early warning is not possible or units are forced to occupy or traverse contaminated environments, protection provides life sustainment and continued operational capability in the NBC environment. The two types of non-medical protection are individual and collective.

- ***Individual protective equipment*** (IPE) includes protective masks and clothing. Protective masks that reduce respiratory stress on the user while improving compatibility with weapon sighting systems and reduce weight and cost are being developed. Technology advances are being pursued to produce mask systems that provide fully compatible vision capabilities, laser/ballistic protection, and further reduction in logistics burden. Protective clothing is being developed which will present less weight and heat stress burden than present equipment.

- ***Collective protection equipment*** includes shelters for command posts, medical facilities, rest and relief shelters/buildings, vehicular collective protection, and safe zones aboard ships. Lightweight shelters with integrated environmental control and power generation capabilities are being developed. Technology improvements are being pursued to reduce weight and size and improve deployability. Technology improvements that reduce logistic and manpower requirements; *e.g.*, filter change frequency and shelter assembly and disassembly time are also being pursued.

2.4.1 Protection Science and Technology Efforts

2.4.1.1 Goals and Timeframes. The goals of the protection subarea are to maintain a high level of protection against CB warfare agents and radiological particles while reducing the physiological burden associated with wearing protective equipment; to integrate CB protection with protection from environmental, ballistic and other threats; and to provide a protective environment for personnel to complete their mission while operating in aircraft, armored vehicles, ships, shelters and other large-area enclosures (see Table 2-5). To achieve these goals, physiological performance requirements key to the design and evaluation of clothing and respirators are being established. New barrier and filtration materials, and permeable fabrics to accommodate these performance requirements, are being developed and evaluated. Regenerative filtration materials and techniques that would virtually eliminate the need to replace collective protection filters are being explored.

Table 2-5. Protection Science and Technology Strategy

By 1997	By 2002	By 2007
• Prototype mask with 50% reduced breathing resistance and 50% improved field of vision • Demo Joint Service Lightweight Suit Technology (JSLIST Component)	• Demonstrate regenerative filter prototype • Demonstrate advanced adsorbents to enhance or replace carbon • New chemical protective clothing, gloves and footware materials transition to the Force XXI Land Warrior • Personal air conditioner backpack weighing less than 10 pounds	• Continuous operations filter technology • Lightweight materials available

2.4.1.2 Potential Payoffs and Transition Opportunities. Individual protection investments will result in improved respiratory and percutaneous (skin) protection with reduced physiological and psychological burden to the individual soldier. Improved air purification systems for collective protection applications will allow for extended operations enclosures in a CB contaminated environment and reduce the logistics burden associated with filter replacement. Filtration technology has commercial application to the chemical industry and for automotive applications.

2.4.1.3 Major Technical Challenges. Integrating CB protection into future warrior systems necessitates tradeoffs between performance requirements and limitations of materials and designs. Integral respiratory protection requires tradeoffs between physiological performance parameters such as pulmonary function, field of view, speech intelligibility and anthropometric sizing against cost, size/weight, protection time, and interfacing with other equipment. Integral CB protective clothing requires tradeoffs between minimizing thermal stress and moisture buildup against agent resistance, weight/bulk and power requirements of cooling systems. Air purification systems require tradeoffs with respect to size, weight and power requirements, as well as longer life and minimal environmental impact.

2.4.2 Protection Modernization Strategy

Forces cannot always avoid NBC hazards, therefore individual warfighting units must be provided materiel to protect them from the effects of these lethal agents. Protection must be effective against all known threats and not measurably degrade the performance of personnel, weapons, or equipment. Total NBC protective measures, which consist of individual and collective protection, allow our forces to maintain combat superiority in a contaminated environment. A summary of protection modernization requirements is provided in Table 2-6.

The goal of the protection RDA area is to provide equipment which allows US forces to operate in a contaminated NBC environment with minimal degradation of the warfighters' performance. The near-, mid-, and far-term project efforts are aimed at maintaining current protection levels while reducing physiological and logistical burdens. Table 2-7 provides an overview of individual and collective protection RDA efforts and Service involvement.

Individual protection equipment (IPE) consists of eye/respiratory and percutaneous protection: a mask with hood and protective garments, boots, and gloves. The IPE issued to US forces protects against all threat chemical and biological agents. Its chemical defense capabilities are routinely demonstrated with actual chemical agents in the Chemical Defense Training Facility (CDTF), U.S. Army Chemical School, Ft. McClellan, Alabama.

Protective masks will be improved to provide greater user comfort and to reduce the breathing resistance currently encountered. Mask systems will require increased NBC survivability and compatibility with combat or personal equipment. Future respiratory systems, such as the A/P23P-14(V)N , the M45, and the far-term Joint Service Aviator Mask (JSAM) and Joint Service General Purpose Mask (JSGPM) will require enhanced compatibility with both life support and tactical systems on fixed and rotary wing aircraft. In the future, the focus will be on integrated respiratory protective ensembles which offer optimal compatibility with personal, tactical and crew support systems.

Table 2-6. Protection Modernization Strategy

	NEAR (FY97-00)	MID (FY01-05)	FAR (FY06-11)
Individual Eye/ Respiratory	• **Voice amplification; laser/ballistic eye protection; improved decontamin-ability, better comfort (M40A1/M42A1)** • Army -*Aircrew mask compatible with sighting systems and night vision goggles (M48/49)* • Army -*Improved compatibility with aviation sighting/night vision systems; protection against future threats agents (M45)*	• **Reduced physiological burden, improved comfort, enhanced optical and communications cooling** • Navy -*Improved complete protection for all aircrews (A/P 23P-14(V)N)*	• **Advanced Integrated Individual Soldier Protection system (Future Soldier System)** • **Improved multiple agent protection**
Individual Clothing	• **Advanced protective suit technology; lighter, improved agent and flame protection; reduced heat stress integrated with all respiratory and micro-climatic cooling systems (JSLIST)** **- Improved foot protection (MULO)** **- Improved hand protection (Improved CB Glove)** • Army -*Improved protection with self contained breathing capability for special purposes (STEPO-I)*	• **Improved protection, less burdensome protective suits; improved foot and hand protection/less burdensome (JSLIST)**	• **Integrated multiple threat modular protection (chemical, biological, environmental, ballistic direct energy and flame)** • **Improved protection, less burdensome protective suits; improved foot and hand protection/less burdensome (JSLIST P3I)**
Collective Systems	• **Improved filters to extend filter life, reduce maintenance and reduce logistical burden** • Navy - *Backfit ships with contamination free protected zones - (Selected Area Collective Protection System SACPS)* Marine Corps -*Protection for all combat vehicles and unit shelters* • Army -*NBC protection for tactical Medical units - CB Protective Shelter (CBPS)*	• **Regenerable protective filtration for vehicles/vans; reduces logistics burden, size, weight, power needs protects against future threat agents** • Army -*Modular, reduced size, weight and power for vehicle/ shelter collective protection - Advanced Integrated Collective Protection Shelter (AICPS)*	• **Family of advanced lightweight protective filtration systems for vehicles, shelters, ships, light forces**

1. Joint Service programs are highlighted in **BOLD**, Service unique efforts are *italicized.*
2. Where applicable, systems which meet requirements are listed following the entry.

Table 2-7. Protection RDA Efforts

Category	Nomenclature	Status	USA	USAF	USMC	USN
	INDIVIDUAL PROTECTION:					
Integrated	- Force XXI Land Warrior	RDTE	Rqmt	Interest	Interest	Interest
Eye/ Respiratory Protective Masks	- MBU-19/P Aircrew Eye/respiratory Protection (AERP)	Production	Interest	Fielded	Interest	
	- M48/49 Aircraft Mask	RDTE	Rqmt			
	- CB Respiratory System (A/P 23P-14(V)N)	RDTE			Rqmt	
	- M45 Aircrew Protective Mask (ACPM)	RDTE	Rqmt		Interest	
	- M40A1/M42A1	Production	Rqmt		Rqmt	
	- MCU-2A/P	Production		Fielded		Rqmt
Ancillary Equipment	- Protection Assessment Test System (PATS)	Production	Rqmt	Fielding	Fielded	Interest
	- Voice Communication Adapter	Production	Rqmt	Rqmt	Fielded	Fielded
Battlefield Protective Suits	- CB Protective Overgarment Saratoga	Fielded	Interest		Fielded	Interest
	- Chemical Protective Undergarment (CPU)	Fielded	Rqmt		Int-NIR	
	- Aircrew Uniform Integrated Battlefield (AUIB)	Production	Rqmt	Fielded	Int-NIR	
	- Joint Service Lightweight Integrated Suit Technology (JSLIST)	RDTE				
	-- Overgarment	*	Rqmt	Rqmt	Rqmt	Rqmt
	-- Undergarment	*	Rqmt	Interest	Interest	
	-- Duty Uniform	*	Rqmt	Rqmt	Rqmt	
	-- Boots		Rqmt	Rqmt	Rqmt	
	-- Gloves	*	Rqmt	Rqmt	Rqmt	
Specialty Suits	-Suit Toxicological Environmental Protective Outfit (STEPO-I)	Production	Rqmt			
	- EOD Ensemble	Production	Rqmt			
	- Improved Toxicological Agent Protective (ITAP)	RDTE	Rqmt	Rqmt	Interest	Interest
	COLLECTIVE PROTECTION					
Collective Protection Equipment	- M20A1/M28 Simplified CPE	Fielded	Rqmt			
	-Modular CPE (GPFU)	Fielded	Rqmt	Interest		Interest
	- CB Protected shelter (CBPS) (Medical)	Production	Rqmt		Interest	*
	- Advance Integrated Collective Protective System (AICPS) for Vehicle, Vans, and Shelters	RDTE	Rqmt		Interest	
	- Selected Area Collective Protection System (SACPS)	Production				Rqmt
	Shipboard Collective Protection Systems					
	- Shipboard Collective Protection System (CPS)	Production	Interest	Interest		Rqmt
	- Improved Shipboard CPS	RDTE				Rqmt

Rqmt = Product requirement
Interest = Product Interest
Int-NIR = Product Interest, No Imminent Requirement

* - Sub-Product(s) of a Consolidated Joint Service Project
Rqmt, Interest = Sub-Product requirement or Interest

Future protective clothing ensembles will be required for land, sea, air, and marine forces to achieve reductions in bulk and weight without any loss of protection or durability. To satisfy these needs, the four Services have consolidated their mission specific requirements into a first truly joint evaluation program for the next generation chemical garments--the Joint Service Lightweight Integrated Suit Technology (JSLIST) program. New accessories, such as gloves and footwear, are also required to execute missions and tasks which require greater tactility and traction. Similarly, clothing systems for Explosive Ordnance Disposal (EOD) personnel are required to enhance existing chemical protection systems without undue physiological burdens.

Collective protection equipment (CPE) development efforts are focused on NBC protection systems at the crew, unit, and platform level. New CPE systems will be smaller, lighter, less costly and more easily supported logistically. New systems are required to make "clean" environments more available for critical operations (*i.e.*, where IPE otherwise places an unacceptable burden upon the Service member in performing duties) and for essential rest and relief. Modernization concentrates on: (1) improved air filtration and environmental control methodologies and integration, (2) advanced technologies integrated into power and ventilation for systems that offer a significant improvement in logistics, (3) applications on essential vehicles, vans and shelters, and (4) improvements to current vapor and particulate filtration media to extend filter life. Efforts are in place to support major weapons systems developments such as the V-22 Osprey, the Comanche, and Armored Vehicles.

2.4.3 Joint Service Protection Programs

Joint programs are shown in Table 2-6 as bolded entries. A detailed description of Joint IPE and CPE programs is at Annex B.

Individual Protection

Eye/Respiratory. The M40 and M42 masks (for individuals and armored vehicle crewmen, respectively) are undergoing the final stages of fielding to replace their M17 and M25 series counterparts. The new masks offer increased protection, improved fit and comfort, ease of filter change, better compatibility with weapon sights, and a second skin which is compatible with Army and Marine Corps protective ensembles. The second skin design also is being reviewed by the Navy and Air Force for potential adoption. The Army, Marines, and Air Force are also fielding the Protection Assessment Test Systems (PATS) to provide users of the M40, M42, and MCU-2/P masks with a rapid and simple means for validating the fit and function of the mask to ensure readiness. The Navy is evaluating using PATS with its MCU-2/P series mask.

The Navy, in coordination with the Marine Corps, is leading an effort to equip all forward deployed fixed and rotary wing aircrew with improved chemical, biological, and radiological (CBR) protection. The CBR ensembles will feature off-the-shelf items, such as the A/P23P-14(V)N respirator assembly. The Army, in cooperation with the Marine Corps, recently completed a product improvement program for the M40 series mask. The Air Force continues to field Aircrew Eye-Respiratory Protection (AERP) systems to protect aircrews from CB hazards. This system complements the recently fielded lighter weight aircrew ensemble.

Mid- and far-term, research is focused on improved vapor and particulate filtration technology, as well as improved masks for light and special operations forces (SOF). Far-term plans include the Joint Service Aviation Mask and Joint Service General Purpose Mask, which will provide improved eye, respiratory, and face protection against current and future agents. It will maximize compatibility with future weapon systems, be lightweight, and offer modular facepieces to accommodate a variety of mission profiles.

Clothing. In the area of full body protection, the JSLIST program is underway to coordinate the selection of advanced technology chemical protective materials and prototype ensembles. The program originated as a US Marine Corps 6.2 and 6.3 demonstration of chemical protective materials and garment designs. In August 1992, the Service Project Managers for chemical protective clothing agreed to combine their programs, using the initial Marine Corps data base and other R&D efforts. Requirements for chemical protection, durability, heat stress reduction, launderability, concept of use and flame protection vary by Service and mission.

Clothing systems will utilize new material technologies from domestic and foreign sources. There will be one overgarment design, one primary garment design, and one undergarment design. The scheme will minimize the number of suits and maximize inter-Service compatibility. Merging development efforts will eliminate unnecessary duplications and allow each Service to leverage those technologies which offer the best merit and performance. Materials which meet Services' requirements will be placed on a qualified materials list to encourage multi-source competition and to provide surge capability. Variations in suit design will be minimized to gain economies of scale in production and help maintain a vital industrial base.

The Army, in coordination with the other Services, and as a part of JSLIST, is conducting a development project for a Multipurpose Overboot to replace the current black vinyl overboot with a boot that has greater durability, better traction on all surfaces and improved protection. A similar effort is underway for an Improved CB Protective glove which will have better tactility and protection. Both project schedules are being executed in parallel with the JSLIST program.

In the mid-term, the Army in coordination with the other three Services, is developing an Improved Toxicological Agent Protective (ITAP) ensemble for EOD and depot operations in Immediate Danger to Life and Health (IDLH) contamination concentrations. The ITAP ensemble will incorporate improvements in material and design. It includes a one-hour supplied air bottle system, which can be switched to a filtered air respirator when operators exit the area of high contamination. A Personal Ice Cooling System (PICS) is being developed for use with the ITAP. The ITAP ensemble and PICS will be Joint Service programs. In addition, the Army is working with the Air Force on a chemical protective firefighter's ensemble leveraging the technology from the JSLIST program. Detailed system requirements and program plans are currently being coordinated among the Services.

In the far-term, efforts will focus on integrated protection for the Force XXI Land Warrior System. This next generation technology will be directed toward integrating CB protection into a system which will also provide environmental, ballistic, directed energy and flame protection, as well as reduced physiological burden. A strong emphasis on supporting technologies must continue. Materials that detoxify a broad range of chemical and biological agents on contact, which can be incorporated into fibers, fabrics and semi-permeable membranes are being developed using biotechnology as well as more conventional approaches.

Collective Protection

The Army has fielded the M20A1/M28 Simplified CPE to provide CP protection and environmental control to existing structures. The new simplified CPE provides liquid agent resistance and allows expansion of protected area.

The Chemical/Biological Protective Shelter (CBPS) is going into production to provide clean areas in mobile field hospitals.

Near-term collective protection efforts, such as the Advanced Integrated Collective Protection System (AICPS) will provide a compact, integrated package for power, filtration, and environmental control (heating/cooling). The AICPS will provide transportability and maintainability enhancements and decrease system set-up times. The Navy Improved Collective Protective System (ICPS) effort will increase the shipboard filter life (from the current one or two years) to at least a three year service life, through the use of new pre-filter materials and the use of a new HEPA filter media. The ICPS will provide millions of dollars of savings in life cycle costs.

2.4.4 Other Protection Programs

Program supporting requirements of a single service are shown in table 2-6 as italicized entries. A detailed description of IPE and CPE projects is presented in Annex B.

Individual Protection

Eye/Respiratory. The Army is developing the M48/49 protective masks to replace the M43 series masks. The M48 will be for Apache pilots and the M49 for general aviator use. They will be lighter and offer enhanced protection and compatibility with night vision and aircrew system.

In the near-term, the Army will replace the M43 mask for the general aviator with the Aircrew Protective Mask, M45. The M45 will be lighter and less expensive than the M43 and feature CB protection without the aid of force ventilated air.

Clothing. The Aircrew Uniform Integrated Battlefield (AUIB) and the Chemical Protective Undergarment (CPU) are approved for procurement. The AUIB is a flame resistant CB protective uniform which is lighter and less bulky than previous ensemble configurations. The CPU, which has been adopted by armor crews, is worn under the Nomex coverall.

The Army has also completed fielding the Interim-Self-Contained Toxic Environment Protective Outfit (STEPO-I). The STEPO-I was introduced for limited EOD and depot operations in contamination concentrations which are of Immediate Danger to Life and Health (IDLH).

Collective Protection

The Navy now includes the Collective Protection System (CPS) on all new construction ships. Currently the DDG-51, LHD-1, AOE-6 and LSD-41 ship classes are being built with CPS. The Navy also has the capability to backfit CPS on ships already in Service. The Selected Area Collective Protective Systems (SACPS) has been installed on selected LHA-1 class ships. Air inside the zone is maintained at a higher pressure than the outside air to prevent leakage of contaminants into the protected zone. In the mid-term, the Navy is designing the V-22 Osprey to be the first Naval aircraft to incorporate CBR protection for both aircrew and passengers. The ability to provide a pressurized, contamination free environment is a design requirement.

2.5 DECONTAMINATION

When contamination cannot be avoided, personnel and equipment must be decontaminated to reduce or eliminate hazards after NBC weapons employment. Decontamination systems provide a force regeneration capability for units that become contaminated. Modular decontamination systems are being developed to provide decontamination units with the capability to tailor their equipment to specific missions. Technology advances in sorbents, coatings, catalysis, and physical removal will reduce logistics burden, manpower requirements and lost operational capability associated with decontamination operations. The following sections detail CB decontamination science and technology efforts, modernization strategy, and Joint Service programs.

2.5.1 Decontamination Science and Technology Efforts

2.5.1.1 Goals and Timeframes. The goal of decontamination research and development is to develop technologies that will eliminate toxic materials without performance degradation to the contaminated object and be environmentally safe (see Table 2-8). This area includes decontamination of personnel, individual equipment, tactical combat vehicles, aircraft, facilities, and fixed sites. Decontamination technologies currently being pursued include enzymes, catalysts that improve reactivity, decontaminants that are effective in both fresh and brackish water, and improved reactive sorbents. Contamination control involves investigating procedures that minimize the extent of contamination pickup and transfer, and maximize the ability to eliminate the contamination pickup on-the-move as well as during decontamination operations.

Table 2-8. Decontamination Science and Technology Strategy

By 1997	By 2002	By 2007
• Demo improved sorbents • Aircraft Interior Decon procedures (non-system)	• Sensitive Equipment Decon Systems • Demonstrate enzymatic decon • Improved decon material to replace DS 2	• Demonstrate environmentally safe, sensitive equipment and decon materials • New self-decontaminating materials

2.5.1.2 Potential Payoffs and Transition Opportunities. The payoff from enhanced decontaminants and decontamination systems will be new non-corrosive, non-toxic, non-flammable, and environmentally safe decontamination systems suitable for a timely elimination of CB agents from all materials and surfaces. This ability will allow the forces to reconstitute personnel and equipment more quickly to increase combat efficiency and lessen the logistic burdens. In the future, reactive coatings may allow the continuation of combat operations without the need to disengage for decontamination. Dual use potential for environmental remediation, especially those dealing with pesticide contamination, is being exploited.

2.5.1.3 Major Technical Challenges. There are two principle technical difficulties associated with this effort. The first is the development of decontaminants which are reactive, non-aqueous, non-corrosive, safe to use on sensitive equipment, decontaminate a broad spectrum of chemical and biological agents, and environmentally safe. The second technical difficulty is the development of decontamination systems that effectively clean all surfaces and materials, while at the same time reduce the manpower and logistics burden. Also, new concepts or technologies for decontamination of large areas are needed.

2.5.2 Decontamination Modernization Strategy

Decontamination systems provide a force regeneration capability for units that become contaminated. Existing capabilities rely upon the physical application and rinse down of decontaminants on contaminated surfaces. Existing systems are effective against a wide variety of threat agents, yet are slow and labor intensive, and present logistical, environmental, and safety burdens. To improve capabilities in this functional area, the Joint Services place emphasis upon new decontaminating technologies which reduce existing manpower and logistics requirements. They are safer on the environment, the warfighter, and equipment. Table 2-9 shows the roadmap for modernizing decontamination systems in DoD.

The goal of the NBC decontamination program area is to provide technology which removes and detoxifies contaminated material without damaging combat equipment, personnel, or the environment. Research and development of non-corrosive, all-agent multipurpose decontaminants and decontaminating systems for combat equipment, aircraft, personal gear, and skin remains a priority. Alternative technologies, such as sensitive equipment decontamination methods and large scale automated decontamination systems attract interest across the four Services. Table 2-10 provides an overview of Joint Service RDA efforts and Service involvement.

Table 2-9. Decontamination Modernization Strategy

	NEAR (FY97-00)	MID (FY01-05)	FAR (FY06-11)
Skin and Equipment Decontam-inants	• **Less caustic and damaging to equipment (M291/M295)**	• **Non-caustic, non-corrosive decontaminant for personnel and equipment** • Army-*Higher efficiency decon methods (Sorbent Decon)*	
Bulk Decontam-inants	• **Non-caustic, non-corrosive easy to store multipurpose decontaminants**	• **Decontaminants for fixed facilities** • Army -*Environmentally acceptable replacement for DS-2* • Army -*Enzymes for chemical agent decontamination* • Navy -*Less caustic capability*	• Navy -*Contamination resistant shipboard materials*
Expedient Delivery Systems		• **Auto-releasing coatings; reduces skin contact hazard & labor requirements**	• **Self-decontaminating auto releasing coatings; reduces man-power and logistic requirements eliminates skin, contact hazard** • Army -*Advanced non-aqueous self-strip coating to reduce water and labor requirements*
Deliberate Delivery Systems	• **High pressure water wash; mechanical scrubber; improved decontaminate dispenser (increased vehicle throughput)** • Army -*High pressure hot water washing and decontaminate scrubber capability; reduced water, labor, and logistic burden (M21/M22 Modular Decon System)*	• **Non-aqueous capability for electronics, avionics and other sensitive equipment** • Air Force - *Sensitive equipment decontaminants for aircraft interiors*	• **Rapid large scale automated decon capability for fixed sites; reduced manpower and logistic burden** • **Vehicle interior decon capability** • Army -*Waterless decon capability for electronics and avionics*

1. Joint Service programs are highlighted in **BOLD** while Service unique are *italicized.*
2. Where applicable, systems which meet requirements are listed following the entry.

Table 2-10 Decontamination RDA Efforts

Category	Nomenclature	Status	USA	USAF	USMC	USN
Personnel	- M295 Individual Equipment Decontaminating Kit	Production	Fielded	Interest	Fielded	Interest
	- M291 Skin Decontaminating Kit	Production				
Combat Equipment, Vehicles, and Aircraft	- M17A2/A3 Lightweight Decontamination System	Production	Fielded	Interest	Fielded	Interest
	- M21/M22 Modular Decontamination System (MDS)	RDTE	Rqmt	Int-NIR	Int-NIR	Int-NIR
	- M17 Diesel Lightweight Decontamination System	RDTE		Int-NIR	Rqmt	Interest
	- Sensitive Equipment Decon	RDTE	Rqmt	Interest	Interest	Interest
Decontaminant Solutions and Coatings	- Sorbent Decontamination System	RDTE	Rqmt	Interest	Rqmt	Interest

Rqmt = Product Requirement
Interest = Product Interest
Int-NIR = Product Interest, No Imminent Requirement

* = sub-Product(s) of a Consolidated Joint Service Project
Rqmt, Interest = Sub-Product Requirement or Interest

2.5.3 Joint Service Decontamination Programs

The Army has developed the M291 skin decontamination kit as a replacement to the M258A1 decontamination kit for all Services, and is currently introducing the M295 for improved personal equipment decontamination. The M295 provides the warfighter a fast and non-caustic decontamination system for personal gear. The Army and Marine Corps will be the first Services to field the M295.

In the near- and mid- term, DoD continues to research new multi-purpose decontaminants as a replacement for bulk caustic Decontamination Solution 2 (DS2) and corrosive Super Tropical Bleach (STB). New technologies, such as sorbents, enzymatic foams, and reactive decontaminating systems are being explored and may offer operational, logistics, cost, safety, and environmental advantages over current decontaminants. It should be noted that present shipboard chlorine-based decontaminant solutions pose an unacceptable corrosion risk to Naval aircraft. Current procedures require the use of fresh water and normal aircraft detergent solutions.

In the far-term, the Services are seeking non-aqueous decontamination systems to provide for sensitive equipment decontamination at mobile and fixed sites. Additionally, there is interest and research in self-stripping coatings which can reduce or eliminate the necessity of manual decontamination. A detailed description of the decontamination projects is presented in Annex C.

2.5.4 Other Decontamination Programs

In the near- and mid-term, the Army is developing the Modular Decontamination Systems (MDS) to enhance vehicle and crew weapon decontamination. The MDS will support deliberate decontamination for ground forces and possess mechanical scrubbing and improved decontaminant dispensing capabilities. It will also offer a reduction in size, weight, logistics burden, and workload requirements over existing decontamination systems. Similarly, the

Marine Corps is exploring alternative man-portable decontamination systems and is assessing the feasibility of converting the gasoline powered M17 Lightweight Decontamination System (LDS) with a lightweight diesel engine.

2.6 NON-MEDICAL CB DEFENSE REQUIREMENTS ASSESSMENT

➢ **Advanced technologies and new methods are currently being examined for fixed facility decontamination. Follow-up investigations are planned over the next year to determine the requirements necessary to perform decontamination of large areas, including cleaning area to sustain cargo handling operations. Over the past year, the Services have worked together to improve the Joint orientation of NBC defense requirements. The work being accomplished will improve the equipment fielded in the near future. More emphasis needs to be placed on the Warfighting CINCs' requirements as input for equipment research and development. This is necessary to ensure that future equipment meets the needs of the Joint battlespace environment.**

Areas of concern which are addressed under the management improvement initiatives include the following:

- Focusing and prioritizing chemical and biological detector programs to ensure that resources are leveraging the most promising technologies and are not diluted by excessive Service unique requirements.

- Developing advanced individual protection ensembles which minimally degrade an individual's performance for all tasks performed in contaminated environments.

- Determining adequacy of funding for advanced decontamination systems, and review of requirements for large scale decontamination systems. Need to allocate or obtain sufficient funds to define requirements for large area decontamination.

- Identifying requirements for collective protection programs to ensure that enough assets are available to complete missions in a CB environment.

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CHAPTER 3

MEDICAL NUCLEAR, BIOLOGICAL, AND CHEMICAL WARFARE DEFENSE REQUIREMENTS AND RESEARCH AND DEVELOPMENT PROGRAM STATUS

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3.1 REQUIREMENTS

3.1.1 Introduction

The Gulf War, the Tokyo subway nerve gas (sarin) attack in March of 1995, the threatened release of radiocesium in Moscow's Izmailovo Park, and the Department of Defense (DoD) report released in April 1996 entitled *Proliferation: Threat and Response*, illustrate that many countries and terrorist groups have acquired the means for producing chemical, biological and radiological weapons and the means to deliver them. NBC proliferation increases the threat to deployed U.S. forces. In response, our medical chemical, biological and radiological defense research programs' (MCBRDRP) mission is to preserve combat effectiveness by timely provision of medical countermeasures in response to joint service chemical warfare (CW) defense requirements and threats due to validated biological warfare (BW) agents, and threats associated with radiological/nuclear warfare devices (RW). The MCBRDRP has three goals:

(1) Provide individual level protection and prevention to preserve fighting strength;
(2) Maintain technological capabilities to meet present requirements and counter future threats; and
(3) Provide medical management of CW, BW, and RW casualties to enhance survivability and expedite and maximize return to duty.

Chemical warfare agents are available worldwide and include vesicants (blister agents), nerve, blood, and respiratory agents. Biological threat agents include bacteria, viruses, rickettsia, toxins, and physiologically active compounds which can be produced by any group with access to a scientific laboratory or pharmaceutical industry. The primary nuclear threat is the use of conventional explosives to spread nuclear contamination over a limited area or strategic terrain (including usage against reactors or industrial radiation sources) and potentially the use of a single or a small number of crude Hiroshima-type nuclear weapons. Nuclear radiation includes gamma rays and neutrons. Exposure to multiple threats may result in synergistic effects. Assessment methodologies enable threat evaluation and injury assessment. Medical treatment strategies reduce the performance decrement, injury, and death of military personnel in the field, thereby enabling them to accomplish their missions as well as reducing the need for medical resources.

The DoD has maintained a medical research and development program for nuclear, biological, and chemical (NBC) defense for many years. This program has resulted in the fielding of numerous products to protect and treat service members. The DoD program to stockpile biological defense products has been smaller than the chemical defense effort but has received greater emphasis in the past five years.

Specific initiatives programmed to improve NBC medical readiness include:

- Continued emphasis on NBC medical countermeasures research.
- Medical collective protection.
- Identification and testing of medications and therapeutic regimens which reduce the effect of radiation on both bone marrow and the intestinal tract.
- A biological defense immunization policy.
- An award of a prime contract to develop, license, produce, and store biological defense vaccines.
- Enhanced medical diagnostic capability of exposure to all agents.
- Definition of low dose radiation interaction on susceptibility to biological and chemical agents.

3.1.2 Challenges in the Medical NBC Warfare Defense Programs

Medical prophylaxes, pretreatments, and therapies are necessary to protect personnel from the toxic or lethal effects of exposure to all validated threat agents. DoD has fielded a number of medical countermeasures, which greatly improve individual medical protection, treatment, and diagnoses.

DoD complies with all Food, Drug and Cosmetic Act requirements. The Food and Drug Administration (FDA) requires large-scale field trials in human subjects to demonstrate efficacy of drugs and biologicals prior to licensure. There are, however, legal and ethical constraints that preclude such efficacy studies for NBC countermeasures. Field studies of efficacy cannot be performed, since exposure to most NBC agents does not usually occur naturally. Moreover, the high lethality and/or toxicity of NBC agents also makes it unethical to expose human subjects in controlled efficacy studies usually required by the FDA for product licensure (*e.g.*, tests of effectiveness of the product against the threat in humans). For these reasons, many NBC countermeasures are likely to remain in an Investigational New Drug (IND) status, requiring their administration under provisions of an approved protocol and with written informed consent from service members. In contingency situations, DoD may request a waiver of informed consent from the FDA. DoD continues to work with the FDA to seek alternative methods for demonstrating safety and efficacy of NBC medical countermeasures and to obtain their licensure.

Contrary to many media reports[1], medical NBC defense products are thoroughly evaluated and tested for their safety in accordance with FDA guidelines (see figure 3-1) before they are permitted to be administered to any personnel. It is unacceptable for the military to use its own forces as "guinea pigs." All NBC defense medical products must be safe to use and not degrade operational performance. In cases where adverse effects are known or are possible, a decision must be made—and a risk accepted—of the real or potential effects of a medical product versus the catastrophic effects of NBC weapons. Even though efficacy may not be fully understood, the safety (including adverse effects) is extensively understood. In many cases, the

[1] See for example, Victor Sidel quoted in Dave Parks, "Military tries to plug chem defense gaps," *Birmingham News*, p.1; "Gulf War Syndrome," by Ed Bradley on *60 Minutes*, CBS-TV, September 29, 1996; "In general, a sickening syndrome," New York Daily News, December 7, 1996, p. 11; Thomas Tiedt quoted in David Ballingrud, "Ex-researcher: Gulf 'vaccine' was a poison," *St. Petersburg Times*, December 2, 1996, p. 1.

safety is well understood because the medical products have been widely used to treat other medical conditions. (For example, pyridostigmine bromide nerve agent pretreatment has been in use since the 1950s to treat myasthenia gravis, a neuromuscular disorder. The anthrax vaccine has been used since the 1970s to vaccinate veterinarians, textile workers, and others. Various anti-emetics to protect against radiological threats have been used to treat cancer patients undergoing radiation therapy.)

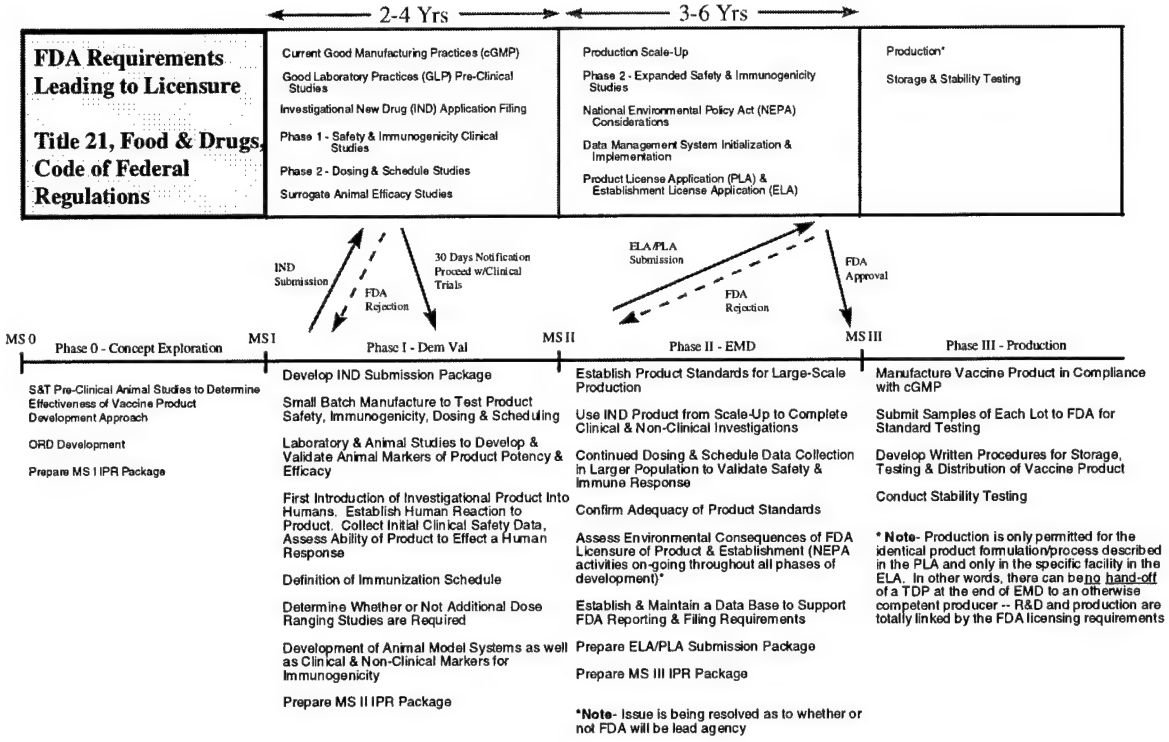

Figure 3-1. Standard FDA Approval Process for Biological Defense Medical Products

The medical NBC defense research programs discussed in this section are divided into chemical, biological, and nuclear areas of research. Table 3-3 (on page 3-16) provides a summary of the medical NBC defense programs and the planned modernization strategy over the next fifteen years.

3.1.3 Reducing Reliance on Research Animals

The FY95 National Defense Authorization Act directed DoD to establish aggressive programs to reduce, refine, or replace the use of research animals. In April 1995, DoD issued Directive 3216.1, "Use of Laboratory Animals in DoD Programs," which mandated standardization of all DoD animal use protocols. The new protocol format requires identification of provisions to reduce, refine, or replace the use of animals. Therefore, an objective of the Medical Chemical, Biological and Nuclear (Radiological) Defense Research Programs is to utilize and develop technologies that will reduce reliance on animal research. In Fiscal Year (FY) 1996, the Medical Chemical, Biological and Nuclear Defense Research

Programs utilized computerized molecular modeling, computer predictions, *in vitro* cell cultures, a cell-free reaction system, a lipid bilayer system, and animal species lower on the phylogenetic scale to refine, reduce, and replace the use of animals.

3.1.4 Medical Program Organization

Chemical/Biological. The U.S. Army is the Executive Agent for the Medical Chemical and Biological Defense Research Programs as prescribed in DoD Directive 5160.5 and, as such, is the lead requirements coordinator. The programs are integrated DoD in-house and external efforts. The Joint Technology Coordinating Group (JTCG) 3 (Medical CW Agent Defense) and JTCG 4 (Medical BW Agent Defense) of the Armed Services Biomedical Research Evaluation and Management (ASBREM) Committee are responsible for the programs' joint consolidation, coordination, and integration. The ASBREM Committee maximizes efficiency by coordinated planning, and minimizes unnecessary program overlaps and costly materiel retrofits. (The integration of program management and oversight of medical and non-medical NBC defense programs is described in chapter 1.) The Army Technology Base Master Plan and the Medical Science and Technology Master Plan are the program drivers for the chemical and biological research programs. The science and technology base is managed through the development and execution of Defense Technology Objectives (DTO) and Science and Technology Objectives (STO). The predevelopment program (basic research; exploratory development; and concept exploration and definition) is directed by the U.S. Army Medical Research and Materiel Command (USAMRMC). The advanced development program (Program Demonstration and Risk Reduction (PDRR); and Engineering and Manufacturing Development (EMD)) for medical *chemical* defense products is directed by the U.S. Army Medical Materiel Development Activity (a USAMRMC asset). The advanced development program (PDRR and EMD) for medical *biological* defense products, including the joint vaccine acquisition program, is directed by the Joint Program Office for Biological Defense (JPO-BD).

Nuclear. The study of the medical and biological effects of ionizing nuclear radiation is performed by the tri-service Armed Forces Radiobiology Research Institute (AFRRI). AFRRI programs are integrated into other DoD in-house and external efforts under the coordination of ASBREM. Specific requirements and tasking for AFRRI research comes from the individual services, Joint Staff, and the Defense Special Weapons Agency (DSWA) through the authority of a Board of Governors (BOG) with funding from the Director, Defense of Research and Engineering (DDR&E) under the Under Secretary of Defense for Acquisitions and Technology. AFRRI is under the administrative control of the Uniformed Services University of the Health Sciences (USUHS). Members of the AFRRI BOG include the President of USUHS, DDR&E, the Assistant to the Secretary of Defense for Nuclear and Chemical and Biological Defense Programs (ATSD(NCB)), the Assistant Secretary of Defense for Health Affairs (ASD(HA)), the Commander of DSWA, and the Surgeons General of the Army, Navy, and Air Force. Major inputs to AFRRI research requirements are driven by the biennial Army Qualitative Research Requirements (QRR), compiled by the U.S. Army Nuclear and Chemical Agency (USANCA).

3.2 MEDICAL CHEMICAL DEFENSE RESEARCH PROGRAM

The mission of the Medical Chemical Defense Research Program (MCDRP) is to preserve combat effectiveness by timely provision of medical countermeasures in response to joint service chemical warfare defense requirements.

3.2.1 Goals

The goals of the MCDRP are the following:

- Maintain technological capability to meet present requirements and counter future threats:
  - Determine sites, mechanisms of action, and effects of exposure to chemical warfare agents with emphasis on exploitation of neuroscience technology and dermal pathophysiology.
  - Identify sites and biochemical mechanisms of action of medical countermeasures.
  - Exploit molecular biology and biotechnology to develop new approaches for medical countermeasures.
  - Exploit molecular modeling and quantitative structure-activity relationships supporting drug discovery and design.
- Provide individual-level prevention and protection to preserve fighting strength:
  - Develop improved prophylaxes, pretreatments, antidotes, and therapeutic countermeasures.
  - Develop skin protectants and decontaminants.
  - Identify factors that influence safety and efficacy properties of candidate countermeasures.
  - Develop and maintain preformulation, formulation, and radiolabeling capabilities.
- Provide medical management of chemical casualties to enhance survival and expedite and maximize return to duty:
  - Develop concepts, and recommend therapeutic regimens and procedures for the management of chemical casualties.
  - Develop diagnostic and prognostic indicators for chemical casualties.
  - Develop life-support equipment for definitive care.

3.2.2 Objectives

The objectives of the MCDRP differ with the varying threats:

- For vesicant (or blister) agents, the objective is to develop a pathophysiological data base on vesicant chemical agents and develop a working hypothesis on how damage occurs at the cellular level. Used with associated technologies, this approach will enable the formulation of definitive pretreatment and treatment strategies, and is expected to produce a realistic concept for medical prophylaxis, immediate post exposure therapy and topical protection.
- For nerve agents, the objective is to field a safe and effective advanced anticonvulsant nerve agent antidote, and develop and field a more effective enzyme reactivator for use with the Mark I Nerve Agent Antidote kit.
- For blood agents, the objective is to develop and field a safe and effective cyanide pretreatment.
- For respiratory agents, the objective is to develop approaches to prophylaxis and therapy by understanding pathophysiological changes after agent exposure.

3.2.3 Threats, Countermeasures, Technical Barriers, and Accomplishments

The chemical warfare threats and countermeasures, as well as chemical defense research and development technical barriers and accomplishments, are outlined in Annex D (Section D.1).

3.3 MEDICAL BIOLOGICAL DEFENSE RESEARCH PROGRAM

The mission of the Medical Biological Defense Research Program (MBDRP) is to develop medical countermeasures to protect U.S. forces and thereby deter, constrain, and defeat the use of biological agents against them (DoD Directive 5160.5, May 1985). The program is directed against agents of biological origin that are validated military threats. A primary concern is the development of vaccines and other medical products that are effective against agents of biological origin (see Table 3-1).

3.3.1 Goals

Goals of the MBDRP include the following:

- Protecting U.S. forces' war fighting capability during a biological attack.
- Reducing vulnerability to validated and novel threats by maintaining a strong technology base.
- Providing medical management of biological warfare casualties.

3.3.2 Objectives

In accomplishing the goals of the MBDRP, efforts are focused on three objectives:

- Prevent morbidity and mortality through the use of vaccines, drugs, and other medical pretreatments.
- Diagnose disease through the use of forward deployable diagnostic kits and

confirmation assays.
- Treat casualties to maximize return to duty through the use of antitoxins, drugs, and other medical treatments.

The MBDRP responds to requirements from the DoD as identified in DoD Directive 6205.3, "Biological Defense Immunization Program," the Joint Service Agreement on Biological Defense, the Joint Warfighting Science and Technology (S&T) Plan, the Defense Technology Assessment Plan, and the Defense S&T Strategy. The MBDRP includes the following areas of research:

- Bacterial studies – Develop potential vaccines and determine the role of these vaccines in the cellular and humoral immune response. Identify virulence factors and protective antigens and the specific genes of these factors/antigens in bacterial threat agents and use this knowledge in the development of second generation recombinant vaccine candidates. Evaluate modern antibiotics for effectiveness in the treatment and/or post-exposure prophylaxis of bacterial threat agents.
- Toxin research - Basic and developmental research leading to methods of prevention and treatment against broad classes of toxins to include use of site-directed mutagenesis and protein engineering of recombinant vaccine candidates.
- Viral and Rickettsial studies – Identify and characterize threat organisms, conduct molecular antigenic analysis, develop diagnostic assays, and investigate pathogenesis, immunology, and epidemiology that will allow decisions regarding the optimal approach to disease prevention and control. Develop vaccine candidates and treatment strategies for viral and rickettsial threat agents.
- Diagnosis – Investigate and evaluate sensitive and specific methods for detection of infectious organisms, toxins, antigens and antibodies in biological materials to include the application of nucleic acid probes or synthetic antigens. Develop rapid identification and diagnostic methods for the assay of toxins, metabolites, and analogs in clinical specimens.

3.3.3 Threats, Countermeasures, Technical Barriers, and Accomplishments

A biological threat agent is defined as an intentionally disseminated living microorganism or toxin that can cause disease or death in humans. Threat agents include a broad range of microorganisms (bacteria, rickettsia, and viruses) and toxins of biological origin. Biological weapons are easy to make, difficult to detect, very effective, and highly selective against humans, animals, or plants. Defense against this class of weapon is difficult, particularly when biological agents can produce casualties over an area of thousands of square kilometers. Biological agents can also be used with devastating effect in combination with nuclear, chemical, or conventional weapons.

Countermeasures and diagnostic techniques for biological weapons are shown in Table 3-1. Critical elements of medical biological defense include the ability to protect U.S. forces from BW agents, to rapidly diagnose (in biological specimens) infection or intoxication from an agent, and to treat casualties. Currently, the most effective countermeasure is pre-

deployment active immunization. Future threats may involve genetically engineered biological weapons that may be easily produced, highly lethal, difficult to detect, and resistant to conventional therapies.[2]

Table 3-1. Medical Biological Defense Countermeasures and Diagnostic Techniques

VACCINES
• *Killed* – killed or inactivated microorganism that is incapable of replicating but stimulates immunity.
• *Live, attenuated* – live organism, genetically selected not to cause disease but able to stimulate immunity.
• *Toxoid* - toxin protein treated to inactivate its toxic quality but retains its ability to stimulate immunity.
• *Recombinant* – section of protein that stimulates specific immunity to a BW agent. Protein section may be produced in high yields through bioengineering.
• *Deoxyribonucleic Acid (DNA)* – section of DNA that codes for section of protein that stimulates specific immunity to a BW agent. DNA appears to produce foreign protein in recipient which stimulates immunity.
• *Polyvalent* – mixture of antigens that protects against a number of different BW agents.
• *Vectored* – carrier organism bioengineered to confer immunity against an unrelated BW agent or multiple agents.
ANTIBODY (ANTISERUM, ANTITOXIN)
• *Heterologous* – antibodies collected from animals (*i.e.*, different species than the recipient) repeatedly immunized against the BW threat. These antibodies must be treated to reduce the human immune response against them (serum sickness).
• *Homologous* – antibodies of human origin (*i.e.*, same species as the recipient) that provide protective immunity against the the BW threat. These antibodies are not prone to stimulating serum sickness.
• *Monoclonal* – a cell culture technique for producing antibodies against a specific disease.
• *Bioengineered* – Antigen binding site on the variable portion of an antibody elicited in a non-human system is combined with the non-variable portion of a human antibody to produce a "humanized" antibody.
DRUGS
• *Antibiotics* – very effective against bacteria but are ineffective against viruses and toxins.
• *Others* – compounds that offer new possibilities for protecting against and treating exposure to BW agents (such as antiviral compounds).
DIAGNOSTIC TECHNOLOGIES
• *Immunological technologies.* These tests rely on antibodies for detecting the presence of foreign proteins associated with the BW agent. They are easy to use, compact, rapid (minutes), and require little logistic support. These tests are currently used in out-patient clinics and doctor's offices.
• *Nucleic acid technologies.* Nucleic acid tests, specifically the polymerase chain reaction (PCR), rely on segments of genes unique to BW agents to detect the presence of those agents. These tests are extremely sensitive and specific, but require more support to perform.

[2] A detailed assessment of the potential impact of new or genetically engineered biological weapons is included in a report prepared by the Department of Defense entitled *Advances in Biotechnology and Genetic Engineering: Implications for the Development of New Biological Warfare Agents*. This report was submitted to Congress in June 1996.

The current MBDRP includes the following research areas for the development of medical countermeasures:

- Characterize the biochemistry, molecular biology, physiology, and morphology of biological warfare threat agents;
- Investigate the pathogenesis and immunology of the disease;
- Determine the mechanism of action of the threat agent in an animal model system;
- Define the sites and mechanisms of action of candidate vaccines;
- Establish safety and efficacy data for candidate vaccines.
- Select antigen(s) for candidate vaccines.
- Develop medical diagnostics and chemo/immunotherapeutic agents and preparations.

Technical shortcomings in the private sector include the lack of high level biological containment (BL-3 and BL-4) laboratory facilities to support biological defense research and scientific expertise in biological defense. These factors restrict the depth of expertise, facilities, and support available. This has become a critical issue in light of current personnel and program downsizing initiatives and the additional emphasis that is being placed on out-sourcing MBDRP work. The technological and scientific expertise for biological defense can therefore be eroded quickly.

Details of the biological warfare threats and countermeasures, as well as biological defense research and development technical barriers and accomplishments, are presented in Annex D (Section D.2).

3.4 MEDICAL NUCLEAR (RADIOLOGICAL) DEFENSE RESEARCH PROGRAM

The mission of the Medical Nuclear Defense Research Program (MNDRP) is to conduct research in the field of radiobiology and related matters essential to the support of the Department of Defense and the Military Services. The sole repository of defense radiobiology expertise is AFRRI.

3.4.1 Goals

The goals of the MNDRP are the following:

- Develop medical countermeasures for the acute, delayed and chronic effects of radiation.
- Design a neutralization plan to respond to "new technology" biological weapons of mass destruction (WMD).
- Identify and quantify hazards of depleted uranium munitions to military and civilian casualties, both female and male.
- Develop rapid bioassay for radiation injury suitable for field deployment
- Produce improved chelating agents for use in treating internal contamination by radioactive heavy metals.

- Sustain combat capability, increase survival, and minimize short- and long-term health problems associated with ionizing radiation alone, and when radiation is combined with other weapons of mass destruction.
- Respond to immediate operational requirements that require expertise in either radiation medicine, health physics or radiobiology.
- Maintain core of scientific expertise necessary to meet current research requirements and to counter current and future radiological threats.
- Provide nuclear radiation weapon effects medical training for DoD medical personnel.

3.4.2 Objectives

The primary objective of this research group is to address the major aspects of military operational requirements for dealing with radiation injuries. A nuclear threat agent is any weapon which causes detrimental medical effects by either direct external irradiation or by internal contamination with radioactive material. These agents include radiation dispersal weapons, which scatter radioactive material with conventional explosives, deliberate area contamination, destruction of a nuclear power plant, improvised nuclear devices and traditional nuclear weapons. Operational requirements include programs in casualty management, medical radioprotectants to diminish radiation injury, medical therapeutic regimens, maintenance of performance, and radiation hazards assessment.

3.4.3 Threats, Countermeasures, Technical Barriers, and Accomplishments

The deployment of a relatively low-yield nuclear device or Hiroshima-type weapon targeted at either a military installation or a political target (*e.g.*, the seat of government, large population center, or commercial port city) is increasingly possible by a terrorist or third-world country. In such a scenario, citizens outside the immediate lethal area would be exposed to the prompt radiation of the initial explosion as well as to chronic exposures resulting from the residual radioactive contamination. The use of radiation dispersal devices, such as the destruction of a nuclear reactor, contamination of a battlefield with nuclear waste, or deliberate radioisotope contamination of the rubble in an Oklahoma City-type conventional explosives attack, is another type of nuclear scenario. Most casualties in these scenarios would suffer non-lethal doses of external irradiation, which would complicate the management of their conventional injuries and could cause internal contamination with radionuclides. (The nuclear weapons inventory of any current adversary is expected to be small, but if the weapon use is for military advantage, concomitant use of biological or chemical weapons is anticipated.)

Early radiation injury diminishes the soldier's ability to fight and survive. Effective radiation countermeasures must protect the soldier from performance decrement and simultaneously diminish lethality and the long-term effects of radiation injury. Therapeutic measures will increase the survival and diminish the morbidity of individual soldiers who are wounded by radiation. A research program to understand molecular and cellular damage induced by radiation is needed to determine the best medical countermeasures for the new radiogenic wounding agents on the modern battlefield. Table 3-2 presents an overview of medical countermeasures to radiological exposure and research accomplishments during FY96.

Table 3-2. Medical Nuclear Defense Countermeasures and Accomplishments

PRETREATMENTS

Multidrug combinations: Animal research has proven that certain radioprotectant drug combinations administered at nontoxic levels interact synergistically to markedly increase mammalian resistance to radiation.

Antiemetics: Granisitron (KytrilR) has been adopted as the NATO standard pretreatment antiemetic medication to significantly block performance degrading early symptoms of radiation injury. This allows mission completion and consequently diminishes the overall casualty rate.

DEPLETED URANIUM TOXICITY

Metabolism of metallic uranium fragments: Prior to the wounding of soldiers in Desert Storm, very little was known about the toxicity of implanted metallic uranium fragments. Previous uranium toxicity studies had been limited to inhaled uranium oxides in uranium workers. Preliminary aspects of animal studies indicate distribution to depot sites throughout the body and potential risks of late effects. Adequate chelation therapy does not exist at this time to increase excretion of this material.

Fetal metabolism of depleted uranium: During the next conflict, it is anticipated that young female soldiers will be wounded by enemy depleted uranium weapons. No knowledge exists of the effects of this material on subsequent pregnancies.

MEDICAL THERAPIES

Specific Cell Line Stimulants: Granulocyte-Macrophage Colony Stimulating Factor has been demonstrated to be highly effective in restoring the immune competence of the bone marrow and allowing survival from radiation injuries previously considered lethal. The cytokine thrombopoietin has been developed as a therapeutic agent and is undergoing further trials as a platelet-formation stimulant.

Broad Range Cellular Recovery Stimulants: Research continues into biologically stable compounds which stimulate recovery of multiple hematopoietic cell lines.

Susceptibility to Infectious Agents and Efficacious Therapy: Research continues to assess susceptibility and resistance to infectious agents in conjunction with use of prompt and chronic sublethal irradiation, and to develop combined modality therapies that attack microorganisms and enhance innate immune response in irradiated personnel.

Internal Contamination Chelation Agents: Currently available chelation agents capable of removing internal radioisotopes are investigational drugs which have been utilized with limited success. More effective ligand-type compounds have been identified and are undergoing evaluation. Other modalities being investigated include seaweed based Alginates which appear to be promising.

DIAGNOSTIC TECHNIQUES

Biodosimetry and Dose Assessment: No dose assessment method other than individual physical dosimeters can be currently made available to deployed soldiers. Automated chromosome dicentromeric analysis has been developed and can be made deployable to the Echelon 3 medical care level, and other, more rapid, methods are being evaluated.

CHEMICAL AND BIOLOGICAL WARFARE INTERACTIONS WITH RADIATION

Increased lethality of biological weapons after low level irradiation: Ongoing studies indicate even low levels of radiation exposure will markedly increase the infectivity of biological weapons. Existing data suggest synergistic interactions of mustard and nerve agents with ionizing radiation.

Significant progress has been made in prophylactic and therapeutic measures that will reduce mortality and morbidity in high dose radiation environments. During the Cold War, the numbers of casualties resulting from the large scale deployment of nuclear weapons would have easily overwhelmed the medical assets of NATO forces. In the current threat environment, adequate planning for medical response to a very limited nuclear attack is mandatory. While casualty numbers from a nuclear detonation will still be large, countermeasures have been developed which will significantly limit the morbidity and the secondary mortality. These modalities will be particularly important in the likely scenario of terrorist use of radiation weapons. If the attack is limited to one or, at worst, a small number of events, the ability to provide intensive, sophisticated medical and other support is highly credible because of the availability of uncompromised treatment/research centers and medical evacuation capabilities.

Details of the radiological threats and countermeasures, as well as nuclear defense research and development technical barriers and accomplishments, are presented in Annex D (Section D.3).

3.5 MEDICAL NBC RESEARCH PROJECTION

Table 3-3 presents a projection of the medical NBC defense programs and modernization strategy for the next 15 years.

Table 3-3. Medical NBC Defense Programs and Modernization Strategy

	NEAR (FY97-99)	MID (FY00-04)	FAR (FY05-11)
Medical - Chemical Defense	Licensed Topical Skin Protectant	Licensed Advanced Anticonvulsant Licensed Cyanide Pretreatment Licensed Multi-chambered Autoinjector	Licensed Reactive Topical Skin Protectant Licensed Advanced Prophylaxis for Chemical Warfare Agents Licensed Specific Protection and Treatment for Blister Agents (vesicant agent countermeasures) Licensed Vesicant Agent Prophylaxis
Medical - Biological Defense	Anthrax vaccine Relicensure	Licensed Q fever chloroform-methanol residue (CMR) vaccine Licensed Tularemia vaccine Licensed Vaccinia, cell culture derived vaccine Licensed Botulinum A/B/E/F monovalent vaccines Rapid Diagnostic Kit for Biological Warfare Threat Agents	Licensed Botulinum Tetravalent vaccine Licensed Botulinum C vaccine Licensed Botulinum D vaccine Licensed Botulinum G vaccine Licensed Ricin vaccine Licensed Staphylococcal Enterotoxin B (SEB) vaccine Licensed new Plague vaccine Licensed new Venezuelan Equine Encephalomyelitis (VEE) vaccine Licensed combined VEE, Western Equine Encephalomyelitis (WEE), & Eastern Equine Encephalomyelitis (EEE) vaccine Licensed Brucellosis vaccine Licensed new Anthrax vaccine
Medical - Nuclear Defense	Depleted uranium shrapnel toxicity assessment Evaluation of new chelation agents (ligands and Alginates) Multidrug radioprotectants validated Combination cytokine therapy validated Echelon 3 fieldable biodosimetry Licensed novel drug-delivery systems Risk Assessment for low-dose, low-dose rate radiation effect	Licensed treatment modalities for depleted uranium shrapnel casualties Radioprotectant transdermal patches New generation prophylactic and therapeutic immunomodulators for multi-organ injuries Computer models to understand effects resulting from combined NBC attacks	Licensed Radiation-induced cancer/mutation preventive techniques Licensed Countermeasure for Chem-Bio-Radiation interaction

3.6 MEDICAL R&D REQUIREMENTS ASSESSMENT

➢ **DoD lacks FDA licensed vaccines against BW threat agents.**

SOLUTION: The DoD will award a prime systems contract during FY97 for the acquisition of vaccines, to include advanced development, FDA licensure, production, storage and testing. In addition, DoD will complete an assessment of vaccine requirements and update vaccination policy for U.S. forces in order to define the cost and scope of the program.

➢ **The effects on humans resulting from the exposure to low doses of chemical agents, particularly organophosphate (nerve) agents, are not clearly understood.**

SOLUTION: Beginning in FY96, DoD, in association with the Research Working Group of the Interagency Persian Gulf Veterans' Coordinating Board, dedicated $5 million to evaluate the chronic effects of low-dose level exposure to chemical agents. Additional funds have been committed for similar and follow-on research in FY97. Studies will address both vesicants as well as nerve agents. Funds will be used to evaluate effects of chemical agents potentially related to chronic health complaints, and for epidemiological projects aimed at identifying health consequences in military personnel potentially exposed to chemical agents.

➢ **The effects on humans of low level radiation, contamination fields, radiogenic munitions, *i.e.*, depleted uranium, and their interactions with chemical and biological weapons have not been evaluated. All preliminary data indicate a high probability that interactions will result in markedly increased numbers of casualties.**

SOLUTION: Definitive assessment of NBC threat interactions and NBC agent modeling will support the strategic design and development of specific preventative and treatment countermeasures.

CHAPTER 4

NUCLEAR, BIOLOGICAL AND CHEMICAL WARFARE DEFENSE LOGISTICS STATUS

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4.1 INTRODUCTION

Nuclear, biological and chemical (NBC) defense logistics support is a critical area that requires extensive coordination and integration. Two Joint organizations exist to coordinate actions in this area: the Joint Services Coordination Committee for Chemical Defense Equipment (JSCC-CDE) and the Joint Service Materiel Group (JSMG). The JSCC was chartered under the Joint Materiel Priorities and Allocations Board (JMPAB) during Operation Desert Shield/Storm. The JSMG was established by the Joint Service Agreement (JSA) of August 1994. While both the JSCC and the JSMG have been chartered to address NBC defense logistics issues, there are differences in their emphasis. The JSCC is primarily a war-time agency, charged with recommending allocations of NBC defense equipment among the four Services in time of war. Their last meeting was in January 1995. The JSCC is currently focused on the Joint Services Chemical Defense Consumption Rates (JCHEMRATES) study to determine CDE expenditures for a two nearly simultaneous MRC scenario. The emphasis of the JSMG is on ensuring a smooth transition from research and development through production to fielding, sustainment, and retirement. It is also charged with developing and maintaining the Joint Service NBC Defense Logistics Support Plan.

Three problems remain from last year regarding the accountability and management of NBC defense item inventories:

- The Services continue to have very limited asset visibility of consumable NBC defense items below the wholesale level. This has the full attention of the senior NBC Defense managers.

- While the Defense Acquisition Board (DAB) tasked the Joint NBC Defense Board to recommend secondary item procurement policy, the Services still procure consumable NBC defense items through multiple, separate, and distinct funding authorizations, as discussed in Section 4.6 of this chapter.

- The Army continues to divide the responsibility for accountability and management of NBC defense equipment between two offices. Program management of NBC defense items that are classified as major end items is a responsibility of the Deputy Chief of Staff for Operations and Plans, whereas management of items classified as secondary items and inventory status are the responsibility of the Deputy Chief of Staff for Logistics. Automated systems allow accurate inventory management of the Army major end items, but not yet for consumable, secondary items at retail level.

The JSMG developed a Joint Service NBC Defense Logistics Support Plan (LSP) during 1996. The plan links the acquisition process with the sustainment of fielded NBC defense equipment, to include information on industrial base and war reserve issues. In an effort to focus on critical issues, the Integrated Product Team responsible for developing the LSP reviewed 18 representative NBC defense items, consumables and parts.

The LSP identified several short, mid, and long-term strategies to implement process improvements. *Short-term strategies* include forming Joint Service working groups to focus on unit asset visibility, wholesale/retail surveillance, shelf-life management, DLA management of parts, forecasting total item demand, and configuration management control of fielded NBC defense items. *Mid-term strategies* aim at empowering the JSMG to manage implementation of logistics process improvements, such as hosting an annual readiness and sustainment review, developing war reserve numbers, determining NBC defense requirements for U.S. civilians in theater, and reviewing the policy on assisting non-DoD agencies with NBC defense logistics support. *Long-term strategies* focus on the development of a joint service NBC defense logistics process and "Extended Enterprise" for the entire life cycle. This Enterprise would develop a partnership of both medical and non-medical NBC defense agencies in all Services and industry to better coordinate and manage the development, production, and stockpiling of NBC defense equipment.

The LSP is currently being reviewed by the Joint NBC Defense Board. There is general acknowledgment that problems exist in NBC defense logistics but they are not insurmountable. The JSMG has begun drafting a second edition of the LSP. This second edition will examine *all* NBC defense equipment (medical and non-medical), focusing on readiness and sustainment issues.

4.2 NBC DEFENSE LOGISTICS MANAGEMENT

NBC defense logistics management remains in transition. The Joint NBC Defense Board has begun to exercise full authority in this area; and the JSMG, which reports to the Joint NBC Defense Board, has been charged with coordination and integration of logistics readiness. Although the JSMG and its Secretariat have been established, the lack of a dedicated budget and dedicated manpower in the logistics area continues to hinder it in fully exercising its responsibilities.

The DoD NBC defense community continues to rely heavily on the Defense Logistics Agency (DLA) and the Army Materiel Command (AMC). DLA and AMC are the inventory managers or National Inventory Control Points (NICP) for the vast majority of NBC defense items in all four Services. They have responsibility for industrial base development, acquisition, and storage of wholesale peacetime and sustainment wartime stocks. They buy (process procurement actions) and store, if requested, NBC defense materiel for the Services; however, the *Services must provide funding* to DLA and AMC for the procurements.

Currently, only Army owned sustainment stocks are stored in DLA and AMC depots. The other Services store their sustainment stocks at unit level or at their own Service depots/facilities. The stocks held in DLA and AMC wholesale accounts would provide limited back-up for unit-held Service stocks during a contingency. Both DLA and AMC will remain key players in the future NBC defense logistics management system. The Joint NBC Defense Board, through the JSMG, provides coordination and integration, based upon all Services' and commanders-in-chief's (CINCs') inputs. DLA and AMC will continue to provide services such as raw data collection, inventory control, and a distribution infrastructure.

Service inventories of NBC defense items maintained at unit level use either manual records or a semi-automated tracking system. Stocks held at wholesale level are maintained using a separate automated system. Currently, there is little connectivity between the two systems.

For example, the Air Force uses an automated system called Standard Base Supply System (SBSS) to track and monitor supply transactions and stockage at installation level. This system does not provide for connectivity to other installations to link logistics databases. When items are issued to gaining units at an installation, they are generally transferred from SBSS records to non-automated unit records. Additionally, accountability of only selected NBC defense items (e.g., protective masks) is entered and routinely tracked on SBSS. Other NBC defense items, because of reduced logistics coding requirements, are maintained only on non-automated unit records. To correct this deficiency, the Air Force established the Mobility Automated Inventory Tracking System (MAITS) to provide a semi-automated tracking system for chemical warfare defense equipment (CDE) items. MAITS has provided for increased Air Force staff asset visibility for installation CDE stocks, but it does not provide information flow directly into the wholesale databases. This system will, however, provide an interim Air Force CDE logistics tracking net until current Air Force automated databases are linked under the DoD Total Asset Visibility (TAV) program. While other Services' sub-automated databases have different names, their problems are similar. As a result, there is limited Service level asset visibility for NBC defense items. However, the Services are addressing this deficiency under the auspices of TAV, a long-term initiative which will link existing DoD logistics automated systems. Again, the intended product envisioned by the JSMG will address this issue in an effort to display a "big picture" of the inventory status.

4.3 QUANTITIES, CHARACTERISTICS, AND CAPABILITIES

The results of the data collection efforts are compiled in Tables 4-2 through 4-5 in Appendix 1, Logistics Readiness NBC Report Data, located at the end of this chapter. A table is included for each of the four Services.

Under the provisions of Title X of the FY95 Defense Authorization Act, Service Secretaries are responsible for manning, equipping, and training. Hence, the Services develop quantitative and qualitative requirements for NBC defense items. The Joint NBC Defense Board coordinates procurement of NBC defense items based on the Services' requirements.

The items listed under Nomenclature in Tables 4-2 through 4-5 of Appendix 1 are the currently fielded NBC defense items in the Services. The Wartime Requirement quantities are those computed by the Services. Wartime requirements for all four Services include materiel requirements to support active duty, reserve and national guard forces; however, few Army National Guard units are included. Materiel requirements for training and peacetime replacements (wear and tear) are *not* included in the wartime requirements.

The Army and Marine Corps computed wartime requirements based on the need to satisfy the demands of two nearly simultaneous major regional conflicts (MRC). They were computed using JCHEMRATES III. The JCHEMRATES III model computes both initial issue and wartime consumption based on the two nearly simultaneous MRC scenario.

The Navy and Air Force computed wartime requirements based on the force strengths that will deploy to satisfy the demands for any contingencies. They did not use the JCHEMRATES III model because incorrect planning factors used within the JCHEMRATES III model made the results questionable. Service logistics planning factors for wartime consumption quantities were used instead. In contrast to the 120 days sustainment requirement computed by the Army and Marine Corps, the Navy's sustainment (wartime consumption) quantities were based on 60 days for shore units and 90 days for fleet units. *During 1997 all four Services are participating in development of JCHEMRATES IV which will be a more accurate prediction of the initial issue and sustainment quantities required for each Service. Results of this effort should be available for inclusion in next year's Annual Report to Congress.* Because the Services use different methodologies for determining their requirements, no Joint Service requirement is shown. The use of a common methodology (*i.e.*, JCHEMRATES IV) will allow the presentation of Joint Service requirements in future reports.

The *Stocks on-Hand* quantities are wartime stocks being held by the Services. The stocks on-hand represent the total of all serviceable NBC defense materiel available in each of the Services (unit held stocks and stocks in the supply system, to include stocks stored in depots/facilities). Marine Corps prepositioned stocks were inadvertently not counted in this report. They will be included in next year's report. The DLA and AMC depot stocks are included in the Army's Stocks on-Hand since the majority of NBC defense materiel held in DLA and AMC depots is Army owned. Only a small percentage of the stocks are DLA/AMC NICP owned for replacement of Service stocks (upon receipt of a funded requisition). The quantities of stocks on hand are more accurate in this report than in last year's report due to some improvements in asset visibility.

Quantities *On Contract* are those quantities for which a Service or agency has submitted a funded requisition or purchase order but has not received the requisitioned items. Finally, the quantities depicted as *Estimated Procurements* are quantities the Services plan to buy to replace peacetime consumption of NBC defense assets, to include training use and shelf-life expiration, and to buy wartime sustainment stocks. It must be emphasized that these are based on major command estimates of requirements. Actual procurements will be based on funding available.

4.4 LOGISTICS STATUS

During data collection for the FY96 report, information on the inventory status of fielded NBC defense equipment was compiled. From this data, 80 items were reviewed extensively. NBC defense items such as batteries, spare parts, and sub-components were considered as a subset of the primary item for risk assessments, and hence not reviewed separately. Trainers were not included in the assessment process since they do not reflect wartime service requirements. Quantities required for wartime needs were then compared to quantities currently

on-hand. Characteristics and capabilities of selected fielded NBC defense items are discussed in detail in Annexes A-D of this report. The following items have been added to the FY96 report:

- M56 Filter Element Set, Gas Particulate
- M1A1-19 Filter, Precleaner and Particulate
- M2A2 Air Purifier

Of the 80 items extensively reviewed, 45 items were assessed. These were rated as being in a low, moderate, or high risk category based on data as of September 30, 1996. "Risk" was defined as the probability that a shortage in the wartime requirement would exist which would severely impact DoD's capability to respond to a contingency. Shortages were calculated by comparing wartime requirements to wartime on-hand quantities in Tables 4-2 through 4-5. Low risk was assessed if less than a 15% shortage existed (or at least 85% of the wartime requirement was currently on-hand in Service inventories). Moderate risk was assessed if a 16–30% shortage in the wartime requirement existed (or the percentage of the wartime requirement of on-hand quantities is between 70–84%). An item was assessed as being at high risk if the quantity on-hand is less than 70% of the wartime requirement. While some of the items assessed changed from the previous year's report due to obsolescence, assessed items remained as constant as possible to provide for a trend analysis.

RISK ASSESSMENT:

Low –	Services have at least 85 percent of wartime requirement on-hand to support two nearly simultaneous major regional contingencies
Moderate –	Services have between 70 to 84 percent of wartime requirement on-hand to support two nearly simultaneous major regional contingencies
High –	Services have less than 70 percent of wartime requirement on-hand to support two nearly simultaneous major regional contingencies

Table 4-1 contains exhibits which provide the results of the assessment. Programs rated as high or moderate risk are discussed in greater detail at Appendix 2 to this chapter. A three year comparison of data assessments is shown in Figure 4-1.

In comparison to FY95 report data, the percentage of the FY96 report's items in the low risk category increased from 52% to 56%. The percentage of items in moderate risk decreased from 18% to 9%, while the percentage of items in the high risk category increased from 29% to 35%.

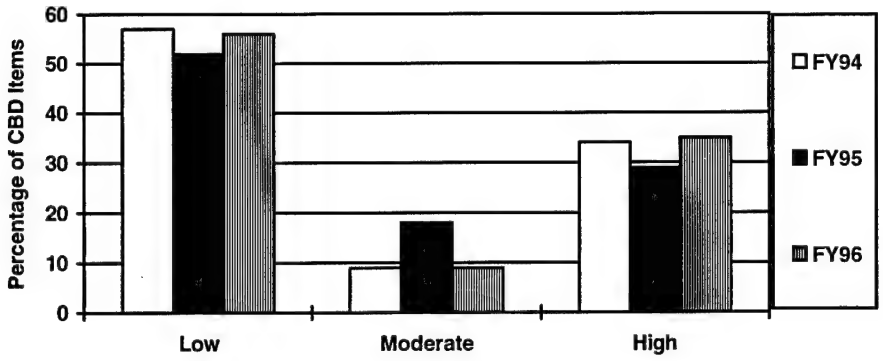

Figure 4-1. Logistic Assessments: Major NBC Defense Items

While these changes reflect only minor fluctuations, the following items are highlighted:

- While quantities of BDOs appear adequate, the shelf life of much of the BDO inventory is reaching its end. There are insufficient procurement funds planned for future replacements, and this threatens a smooth transition to the JSLIST program. As a result, the BDO risk has been assessed as moderate.
- CWU 66/77P remains the only Air Force capability for air crew ensembles with the expiration of the CP undercoverall. The CP undercoverall are being maintained to provide limited backup capability. Inadequate funds and no established procurement contract hamper the ability to correct this assessment in the short term.
- M256A1 detection kits remain high risk due to a lack of procurement orders to fill the shortfall in wartime requirement for the kits.
- While stocks of GVO/BVO pose a high risk, remaining serviceable stocks of CP footwear covers will be available through the upcoming procurement cycle. As a result, the risk posed by the current stockage level of these items was assessed as low.
- While the M291 and M295 Decontamination Kits are assessed as posing a high risk, the inventory shortage of the M291 kits are offset by excess inventory of M258A1 Decontamination Kits, and the status of the M295 kits should improve significantly when the FY97 procurement is executed.
- All collective protection systems pose a high risk at this time, partly due to their only being at the initial fielding stage of issue, but also due to increased emphasis on contamination avoidance and individual protection. As emphasis in these two latter areas has increased, funding for the collective protection program has decreased. As the procurement cycle matures, the risk these systems pose will lessen slightly.
- Some medical NBC defense items appear to be at high risk due to implementation of the Army's Division Ready Brigade (DRB) set initiative. Individual issue chemical defense materiel in now centrally funded, managed and stored in DRB sets for the Department of the Army. A more in-depth discussion on these medical items is included in Chapter 3 and Annex D of this report.

Table 4-1. Logistic Assessments: Major NBC Defense Items

CONTAMINATION AVOIDANCE/DETECTION EQUIPMENT

Items	Assessment	Remarks
Detection Kit, M256A1	High	Low inventory
M8 paper	Low	
Individual Chemical Agent Detector	High	Low inventory. Procurement curtailed
Chemical Agent Alarm, M8A1	High	Procurement curtailed. M22 ACADA will supplement
Chemical Agent Monitor (CAM)/Improved CAM	Moderate	Low Inventory
Chemical Agent Point Detection System (CAPDS)	Low	
Chemical Warfare Directional Detector, AN/KAS-1	Low	
M21 Remote Sensing Chemical Agent Alarm (RSCAAL)	High	Low inventory.
NBC Reconnaissance System "Fox", M93	Low	
Water Testing Kit, M272	Low	
NBC Marking Set, M274	Low	

INDIVIDUAL PROTECTION

Items	Assessment	Remarks
Masks		
M17 Series, General Purpose	Low	Being replaced by M40 (USA/USMC)
MCU-2 A/P	Low	USAF/USN mask
M40, General Purpose	Low	USA/USMC mask
M42, Tank	Low	Replaces M25A1 mask
Mask, M43A1, Apache	High	Being replaced by M48 mask
Mask, MBU-19/9 AERP	High	Replacing MBU-13/P; still fielding
Suits		
Battle Dress Overgarment (BDO)	Moderate	End of shelf life approaching
Saratoga Suit	High	Low inventory
CWU 66/77P	High	Low inventory
Chemical Protective Undercoverall	Low	
Suit, CP, OG, Mk III	Low	
Aircrewman Cape	Low	
Gloves/Overboots		
Chemical Protective Gloves (7/14/25-mil)	Low	
Green/Black Vinyl Overshoes (GVO/BVO)	Low	Risk lowered due to CP footwear cover stocks
Chemical Protective Footwear Covers	Low	Replaced by GVO/BVO
Disposable CP Footwear Covers	Low	
CP Socks	Low	Phase-out item

Note - Only selected Low Risk programs are displayed for information purposes.

Table 4-1. Logistic Assessments: Major NBC Defense Items (continued)

COLLECTIVE PROTECTION

Items	Assessment	Remarks
Shelter, Collective Protective, M20/A1	High	Low stockage; M20A1 being fielded
Portable Collective Protective System	High	Low stockage
Air Purifier, M2A2	High	Initial fielding
Filter, Precleaner and Particulate	High	Initial Fielding

DECONTAMINATION EQUIPMENT

Items	Assessment	Remarks
Skin Decontamination Kit, M258A1	Low	Being replaced by M291
Skin Decontamination Kit, M291	Low	Risk lowered based on M258A1 stocks
Individual Equipment Decontamination Kit, M295	High	FY97 Procurement
Decontaminating Apparatus, M11	Low	On-hand quantity assessed as adequate
Decontaminating Apparatus, M13	Low	
Lightweight Decontamination System, M17A2	Moderate	Modernization Item; still fielding
Power Driven Decontamination Apparatus, M12A1	Moderate	Risk increased due to maintenance
A/E32U-8 Decontamination System	Low	

MEDICAL DEFENSE

Items	Assessment	Remarks
Nerve Agent Antidote Kit (NAAK)	High	DRB component (Army)/item being replaced
Atropine Autoinjector	Low	
2-PAM Chloride Autoinjector	Low	
Nerve Agent Preventative Pyridostigmine (NAPP) Tablet	High	DRB component (Army)
Convulsant Antidote Nerve Agent (CANA)	High	DRB component (Army)/low quantity for Air Force
Biological Warfare Vaccines	High	Prime contract for development, production, FDA licensure, and storage planned

Note - Only selected Low Risk programs are displayed for information purposes.

4.5 PEACETIME REQUIREMENT

In peacetime, NBC defense equipment is necessary to train personnel with the use of the equipment and build confidence that it will provide the necessary protection when used correctly.

Individual protection equipment is maintained at the unit level. Generally, items used in peacetime for training are drawn from contingency stocks, requiring units to maintain both training and contingency stocks. For selected items such as protective clothing, contingency utility is lost when the item is used (or consumed) for training. Because peacetime training requirements are met in this manner, major commands do not track training equipment. The Services, however, have indicated that adequate NBC defense equipment is on-hand to conduct training.

Individual medical chemical defense materiel (*i.e.*, Nerve Agent Antidote Kits (NAAK), Convulsant Antidote Nerve Agent (CANA), Nerve Agent Preventive Pyridostigmine (NAPP) tablets, or more commonly Pyridostigmine Bromide (PB) Tablets) are no longer stored at the unit level (with the exception of those items in Sets, Kits, and Outfits). The Army Medical Department centrally funds and manages these items for units in Division Ready Brigade (DRB) sets. To date, 20 DRB sets have been strategically fielded worldwide. In addition, six DRBs are maintained by the manufacturer (three sets for contingencies and three sets for training. The DRB set contains 15,000 each of NAAK, 5,000 each of CANA, and 1,000 packages of PB tablets. These sets will be issued to deploying units at the direction of the Office of the Surgeon General/Department of the Army Office of the Deputy Chief of Staff for Logistics. One DRB set contains the appropriate individual medical chemical defense materiel for 5,000 personnel. Components of the DRB sets are stored separately since PB tablets must be refrigerated and CANA requires secured storage. Due to the current "investigational new drug" status of the PB tablets, this component will not be issued to units without prior approval from Headquarters, Department of the Army.

4.6 FUNDING

In accordance with the NBC defense management initiatives outlined in Chapter 1, funding of RDT&E and procurement was centralized in a DoD defense-wide account beginning in FY96. However, operations and maintenance (O&M) funding for NBC defense materiel has not been consolidated at the DoD level. Therefore, for non-major (secondary) end items (*e.g.*, consumables, decontamination kits, detection kits, and filters), each Service continues to separately fund replenishment and sustainment of NBC defense equipment. Depot maintenance and contractor logistics support for some of the low density major items are also O&M funded. These appropriations are not included in the joint NBC defense program.

Funding of NBC defense items classified as war reserves secondary items (WRSI) remains a significant issue. The Services are responsible for the funding of items in war reserve stocks. The requirements for these items are developed by each Service. Funding of WRSI is made from Congressional appropriations made into the Defense Business Operations Fund

(DBOF) from transfer of Services' O&M funds. For example, replenishment of NBC defense items in Army war reserves will require substantial funding from 1999 through 2006 as these items reach their maximum extended shelf lives. Funding will be required to replace the Army's current required inventory of BDOs with the Joint Service Lightweight Suit Technology (JSLIST) Advanced Battle Dress Overgarment (ABDO) and to build required initial stockage and minimum sustainment (war reserve) stock to meet the current defense planning guidance. The Marine Corps, through its normal requirements generation and acquisition process, was able to obtain a 100% war reserve; however, when they based their war requirements on the current version of JCHEMRATES, the USMC has a shortage of 500,000 suits. All four Services are currently working together to develop a more accurate JCHEMRATES IV model.

Under the current acquisition procedures and DoD guidance to minimize wholesale stockpiles, procurements are based on funded Service requisitions. The Services remain responsible for program funding to replace NBC defense equipment wartime stocks. Procurement is usually based on economic buy quantities (a consolidation of all Service requisitions) to provide the best value to the government. Some procurements of non-critical items, however, suffer significant delays in delivery to the requisitioner because of the time required to accumulate sufficient requisitions to produce economic buy quantities.

4.7 INDUSTRIAL BASE

In August 1996, DoD published a report titled, *Joint Service Industrial Assessment for the Nuclear, Biological, and Chemical (NBC) Defense Sector*. The assessment provided the Joint NBC Defense Board with a screening tool that identifies critical areas within the NBC defense sector of the DoD industrial base. It built upon the February 1994 NBC Defense Sector study referenced in last year's report to Congress.

The August 1996 report shows a slight improvement over three years ago. Of significance is the decreased number of research and development programs, emphasizing the consolidation efforts of the new joint service initiative and improvements in overall posture of fielded equipment encouraged by Public Law 103-160.

While the sector is improving, vulnerabilities still exist. Operation Desert Storm highlighted a case in which the industrial base did its best to keep spares and repair parts available; yet, there were critical shortages in protective clothing, filters, medical supplies, and batteries for chemical defense equipment. Collective protection systems (filters in particular) continue to be the most critical subsector in the NBC defense area. Additionally, protective clothing procurement continues to receive intense scrutiny due to the possibility of industrial base shortfalls to satisfy requirements during a contingency. Also, the reluctance of pharmaceutical industries to support DoD CB defense medical programs, coupled with a lack of government vaccine production, represents a serious medical industrial base shortcoming.

These assessments indicate that the NBC defense industrial base sector is primarily supported by small- to medium-sized highly specialized companies dedicated to producing military unique products with little or no commercial utility. These companies have become

dependent on Service demands and sales for their financial survival. Selected NBC defense items (BDOs, chemical gloves, and nerve agent autoinjectors) have been designated as critical to combat operations because of low peacetime demand, high wartime use, and the fragile supporting industrial base. As a result DLA established, with OSD approval, a "War Stopper" program to sustain key industrial base capabilities, utilizing industrial preparedness funding under PE 07080110.

Recent changes in the NBC warfare threat and reduced DoD requirements are severely threatening the viability of this sector. DoD is reviewing its industrial base strategies regarding this sector. DLA and AMC, in conjunction with the Services, are developing industrial base approaches which will ensure sustainment of key or critical manufacturing processes and capabilities and ensure that the industrial continues to provide NBC defense items needed on the battlefield.

4.8 NBC DEFENSE LOGISTICS SUPPORT ASSESSMENT

➢ **DoD lacks a joint, integrated system to maintain asset visibility of NBC defense equipment below wholesale level, and lacks a standardized war reserve program for NBC defense equipment. Resourcing the procurement and sustainment of wartime stocks of individual protective equipment, decontamination kits, and detector kits remains the responsibility of the Services.**

***SOLUTION*:** DoD established the requirement for asset visibility and reviewed existing systems and procedures, both for peacetime reporting and war time reporting. The Services and DLA are addressing the NBC defense asset visibility deficiency under the auspices of the Total Asset Visibility initiative.

During 1997 all four Services are participating in development of the JCHEMRATES IV study which will provide a more accurate prediction of the initial issue and sustainment quantities required for each Service than previous studies. Results of this effort should be available for inclusion in next year's Annual Report to Congress. The use of this common methodology will allow the presentation of Joint Service requirements in future reports and facilitate improved joint logistics management.

In November 1996, the JSMG completed a *Joint Service Nuclear, Biological and Chemical Defense Logistics Support Plan.* The plan outlines proposed short-, mid-, and long-term strategies to resolve and overcome many of the problems facing NBC defense equipment readiness and sustainment. The vision for the long-term is to develop a partnership of medical and non-medical NBC defense items in all Services with industry to improve the coordination and management of development, production, and stockpiling/sustaining of NBC defense equipment. The Department continues to pursue innovative strategies to maintain a responsive industrial base, especially those strategies that decrease industry reliance on DoD procurement for industrial base survival. Strategies may include tapping into to independent research and development (IR&D) conducted by universities and corporations, increasing reliance on dual-use technologies, and pursuing strategies that will encourage companies to decrease dependency on DoD requirements for their survival.

APPENDIX 1.
BREAKOUT OF SERVICE WAR REQUIREMENTS, STOCKS ON-HAND, AND PLANNED ACQUISITIONS

The following tables display NBC defense equipment wartime requirements, stocks on-hand quantities, quantities on contract, and FY97 planned procurements for each of the four Services.

(INTENTIONALLY BLANK)

Table 4-2. Army Logistics Readiness NBC Report Data

NOMENCLATURE	NSN	WAR REQ	STOCKS ON HAND	ON CONTRACT	FY 97 (Est. Proc)	COMMENTS
OVERGARMENTS						
SUIT, CP CAMO (BDO)	8415-01-137-1700-07	4,700,000	2,914,871	0	0	End of shelf life approaching, will begin replacing with JSLIST Suit in FY97
SUIT, CP CAMO-DESERT	8415-01-327-5347/5353	2,300,000	1,562,481	0	0	Contingency only, will begin replacing with JSLIST Suit in FY97
SUITS, JSLIST	NOT AVAIL	0	0	0	260,000	
OVERBOOTS/GLOVES						
BLK/GRN VINYL O/BOOTS	8430-01-317-3374-85	4,380,000	2,611,916	0	175,000	Shortages supplemented by Chem Prot Footwear Covers
CP FOOTWEAR COVERS	8430-01-021-5978	0	1,948,611	0	0	Replaced by B/GVOs
CP GLOVES 7 MIL	8415-01-138-2501-04	431,242	318,248	0	0	
CP GLOVES 14 MIL	8415-01-138-2497-00	1,213,032	1,182,735	0	0	
CP GLOVES 25 MIL	8415-01-033-3517-20	5,728,224	7,359,829	0	0	
CB MASKS						
MASK, CB, M17A2	4240-01-143-2017-20	418,472	1,000,190	0	0	Being replaced by M40/M40A1
MASK, CB, M40/M40A1	4240-01-258-0061-63	864,324	1,026,783	141,389	47,205	
MASK, M24, AVIATOR	4240-00-776-4384	12,421	26,355	0	0	Being replaced by M45 and M49 Masks
MASK, M25A1, TANK	4240-00-994-8751-52	38,159	130,109	0	0	Being replaced by M42
MASK, M42, TANK	4240-01-258-0064-66	85,281	114,148	60	24,451	Being updated to M42A2
MASK, M43, APACHE	4240-01-208-6966-69	5,927	2,501	0	0	Being replaced by M48 Mask
MISC PROTECTION						
CP HELMET COVER	8415-01-111-9028	4,091,764	3,211,278	193,110	115,491	
FILTER CAN, C2A1	4240-01-361-1319	2,184,625	1,205,498	472,000	166,000	Total C2 and C2A1 Canisters
FILTER CAN, M10A1	4240-00-127-7186	147,932	165,626	0	0	
FILTER SET, M13A2	4240-00-165-5026	836,944	1,261,932	0	0	
HOOD, M5 (FOR M25A1)	4240-00-860-8987	76,318	214,011	0	0	M25 Mask being replaced by M42
HOOD, M7 (FOR M24)	4240-00-021-8695	30,822	69,776	0	0	M24 Mask being replaced by M45 and M49
HOOD, M6A2 (FOR M17)	4240-00-999-0420	836,944	970,340	0	0	M17 Mask being replaced by M40
HOOD, M40	4240-01-376-3152	2,939,330	1,349,182	562,000	0	
CHEMICAL DETECTION						
ALARM, CAA, M8A1	6665-01-105-5623	38,462	26,620	0	0	Will be supplemented by XM22 ACADA
CHEM AGENT MONITOR /ICAM	6665-01-199-4153	14,939	9,650	468	0	
DET KIT, M256A1	6665-01-133-4964	323,684	111,680	12,000	23,700	
DET PAPER, M8	6665-00-050-8529	1,184,459	1,027,199	0	0	
DET PAPER, M9	6665-01-049-8982	0	9,638	0	0	Replaced by new M9 Paper
DET PAPER, M9	6665-01-226-5589	1,463,137	262,953	367,826	350,000	
NBC RECON SYSTEM	6665-01-372-1303	101	113	0	0	Some used for training
NBC MARK SET, M274	9905-12-124-5955	9,518	9,848	0	0	
WATER TEST KIT, M272	6665-01-134-0885	3,552	9,430	6,954	0	

Table 4-2. Army Logistics Readiness NBC Report Data (continued)

NOMENCLATURE	NSN	WAR REQ	STOCKS ON HAND	ON CONTRACT	FY 97 (Est. Proc)	COMMENTS
DECONTAMINATION EQUIPMENT						
DECON APPAR, M11	4230-00-720-1618	117,814	134,385	0	0	
DECON APPAR, M13	4230-01-133-4124	136,151	180,446	0	0	
DECON KIT, M258A1	4230-01-101-3984	0	404,128	0	0	Replaced by M291 decon kit
DECON KIT, M291 (20/Box)	4230-01-276-1905	113,225	26,957	50,000	44,200	Shortage supplemented by M258A1
DECON KIT, M295 (20/Box)	4230-01-357-8456	107,732	2,080	2,789	1,024	
DS2, 1 1/3 QT	6850-00-753-4827	117,814	195,966	0	0	See below
DS2, 5 GAL	6850-00-753-4870	213,165	315,242	0	0	See below
DS2, M13 CAN	4230-01-136-8888	147,285	36,350	0	0	Total DS2 stocks on hand meet requirements. No longer procuring DS2
L/WT DEC SYS, M17	4230-01-303-5225	2,732	1,785	16	0	
PDDA, M12A1	4230-00-926-9488	844	1,062	0	0	
COLLECTIVE PROTECTION						
AIR PURIFIER, M2A2	4240-00-868-7906	10,000	11	1,963	0	
FILTER, PRECLEANER-PARTICULATE, M1A1-19	4240-01-026-3112	10,000	130	1,000	0	
FILTER SET, GAS PARTICULATE, M56	4240-01-067-5605 4240-01-369-6533	1,092	64	5,286	0	Army as item manager buys 3,000 per year to satisfy Navy requirement.
SHELTER, CO/P, M20/M20A1	4240-01-166-2254	1,945	1,033	230	0	M20A1 on Contract
MEDICAL PRODUCTS						
2-PAM CHLORIDE, AUT	6505-01-125-3248	1,197,437	801,348	0	0	
ATROPINE AUTOINJ	6505-00-926-9083	4,915,888	565,903	15,827	0	
CANA	6505-01-274-0951	2,240,110	382,011	206,430	320,055	
NAAK, MKI	6705-01-174-9919	2,846,601	689,116	461,525	0	Item will be replaced by NSN 6505-01-362-7427.
PYRIDOSTIGIMINE TAB	6505-01-178-7903	985,851	174,074	307,133	140,835	

Table 4-3 Air Force Logistics Readiness NBC Report Data

NOMENCLATURE	NSN	WAR REQ	STOCKS ON HAND	ON CONTRACT	FY 97 (EST PROC)	COMMENTS
OVERGARMENTS						
AIRCREWMAN CAPE	8415-01-040-9018	154,839	158,800		2,978	
CP, UNDERCOVERALL	8415-01-040-3141	0	113,000		0	Expired shelf life; offers limited protection
CWU-66/77/P	8415-01-328-3454(S)	126,000	65,019		5,000	
SUIT, CP CAMO (BDO)	8415-01-137-1700-07	852,899	934,400		37,622	
SUIT, CP CAMO-DESERT	8415-00-324-3087	6,940	9,771		193	
OVERBOOTS/GLOVES						
BLK/GRN VINYL O/BOOTS	8430-01-317-3374-85	790,136	872,885		47,453	
CP FOOTWEAR COVERS	8430-01-021-5978(L)	152,581	229,508		324	
CP SOCKS	8415-01-040-3169	123,774	139,126		0	
DISP FOOTWEAR COVER	8430-00-580-1205	149,830	168,704		0	
CP GLOVES 7 MIL	8415-01-138-2501-04(S)	105,311	205,131		5,533	
CP GLOVES 14 MIL	8415-01-138-2497-00(S)	1,210,626	1,519,197		125,382	
CP GLOVES 25 MIL	8415-01-033-3517-20(S)	135,999	171,229		1,499	
GLOVE INSERTS	8415-00-782-2809 (S)	944,543	921,022		83,559	
CB MASKS						
MASK, AERP	8475-01-339-9782(S)	38,800	21,160		7,200	
MASK, CB, M17A2	4240-01-143-2017-20(S)	7,033	7,272		0	
MASK, MCU-2/P	4240-01-175-3443	67,674	71,910		3,160	
MASK, MCU-2A/P	4240-01-284-3615/17	26,977	44,863		1,908	
MASK, MCU-2A/P(WR) USAF	4240-01-327-3299-301	227,155	249,875		6,024	
MISC PROTECTION						
FILTER CAN, C2/C2A1	4240-01-119-2315	1,120,130	1,455,690		34,069	
FILTER, GP	4240-01-161-3110	250	250		0	
FILTER SET, M13A2	4240-00-165-5026	219,907	207,000		783	
HOOD, FOR MCU-2A/P	4240-01-189-9423	1,437,361	1,796,664		31,079	
HOOD, M6A2 (FOR M17)	4240-00-999-0420	61,054	95,542		0	
MICS (COOL SYSTEM)	4240-01-298-4140YR	323	234		86	
CHEMICAL DETECTION EQUIPMENT						
ALARM, CAA, M8A1	6665-01-105-5623	351	237		127	
CHEM AGENT MONITOR/ICAM	6665-01-199-4153	810	584		228	
CWDD, AN/KAS-1	5855-01-147-4362	6	0		0	
DET KIT, M256A1	6665-01-133-4964	6,130	4,583		508	
DET PAPER, M8	6665-00-050-8529	403,648	740,615		10,650	
DET PAPER, M9	6665-01-049-8982	84,777	84,515		0	
DET PAPER, M9	6665-01-226-5589	276,104	276,551		73,768	
NBC MARK SET, M274	9905-12-124-5955	386	402		19	
WATER TEST KIT, M272	6665-01-134-0885	243	251		2	

Table 4-3 Air Force Logistics Readiness NBC Report Data (continued)

NOMENCLATURE	NSN	WAR REQ	STOCKS ON HAND	ON CONTRACT	FY 97 (EST PROC)	COMMENTS
DECONTAMINATION EQUIPMENT						
A/E32U-8 DECON SYS	4230-01-153-8660	131	125		0	
CALCIUM HYPOCHLORITE	6810-00-255-0471	237	237		11	
DECON KIT, M258A1	4230-01-101-3984	503,649	483,756		24,875	
DECON KIT, M291	4230-01-276-1905	265,230	159,252		65,632	
DRY SORBENT POWDER	4230-01-262-0484	21,438	21,500		62	
L/WT DEC SYS, M17	4230-01-303-5225	91	78		22	
SODIUM HYPOCHLORITE	6810-00-598-7316	795	915		72	
COLLECTIVE PROTECTION						
KMU-450 SHEL MOD KIT	4240-01-044-7659	19	20		0	
MEDICAL PRODUCTS						
2-PAM CHLORIDE, AUT	6505-01-125-3248	841,793	862,320		168,358	
ATROPINE AUTOINJ	6505-00-926-9083	849,421	862,970		169,884	
CANA	6505-01-274-0951	268,735	237,906		134,367	
NAAK, MKI	6705-01-174-9919	0	0		0	
PYRIDOTIGIMINE TAB	6505-01-178-7903	28,183	30,335		5,636	

Table 4-4 Navy Logistics Readiness NBC Report Data

NOMENCLATURE	NSN	WAR REQ	STOCKS ON HAND	ON CONTRACT	FY 97 (Est. Proc)	COMMENTS
OVERGARMENT						
IMPREG UNDERGARMENT	8415-00-782-3242	246	214	0	0	
SUIT, CP CAMO (BDO)	8415-01-137-1700-07	790	612	0	0	Will be replaced by JSLIST
SUIT, CP, OG MK3	8415-01-214-8289-92	253,111	266,072	20,000	1,582	Will be replaced by JSLIST
OVERBOOTS/GLOVES						
BLK/GRN VINYL O/BOOTS	8430-01-317-3374-85	102,177	77,467	0	1,400	
CP FOOTWEAR COVERS	8430-01-021-5978	151,815	197,898	0	0	
CP GLOVES 25 MIL	8415-01-033-3517-20	253,856	294,160	0	1,400	
CPO FOOT COVERS	8430-01-118-8172	717	160	0	0	
CB MASKS						
HOOD, MCU-2/P	4240-01-189-9423	559	523	0	0	
MASK, MCU-2A/P	4240-01-284-3615/17	7,129	6,196	0	0	
MASK, MCU-2A/P (WR) USN	4240-01-327-4148-50	70,342	103,069	5,923	742	
MASK, MCU-2/P	4240-01-173-3443	92,245	101,884	0	0	
MISC PROTECTION						
FILTER CAN, C2/C2A1	4240-01-119-2315	410,129	434,207	0	1,484	
CHEMICAL DETECTION						
ALARM, CAA, M8A1	6665-01-105-5623	108	46	0	0	
CAPDS	6665-01-294-2556	305	300	0	0	
CHEM AGENT MONITOR	6665-01-199-4153	57	260	0	0	
CWDD, AN/KAS-1	5855-01-147-4362	830	917	0	0	
DET KIT, M256A1	6665-01-133-4964	9,181	9,272	0	0	
DET PAPER, M8	6665-00-050-8529	60,559	17,018	0	1,540	
DET PAPER, M9	6665-01-049-8982	17,619	19,662		0	
DET PAPER, M9	6665-01-226-5589	11,451	27,085	0	155	
TUBE PHOSGENE	6665-01-010-7965	3,256	2,807	0	0	
IPDS	NOT AVAIL	305		228		Will replace CAPDS
M21 RSCAAL	6665-01-334-6637	42	0	0	0	New requirement funding pending.
NBC MARK SET, M274	9905-12-124-5955	98	39	0	0	
WATER TEST KIT, M272	6665-01-134-0885	190	80	0	0	

Table 4-4 Navy Logistics Readiness NBC Report Data (continued)

NOMENCLATURE	NSN	WAR REQ	STOCKS ON HAND	ON CONTRACT	FY 97 (Est. Proc)	COMMENTS
DECONTAMINATION EQUIPMENT						
CALCIUM HYPOCHLORITE	6810-00-255-0471	33,188	32,149	0	0	
DECON APPAR, M11	4230-00-720-1618	528	203	0	0	
DECON KIT, M258A1	4230-01-101-3984	69,486	74,035	0	0	
DECON KIT, M291	4230-01-276-1905	131,364	127,628	0	0	
M-17 DECON APPAR	4230-01-346-3122	33	2	0	0	New requirement. Plan to buy 28 in FY98.
COLLECTIVE PROTECTION						
PCPS	4240-01-105-5521	627	0	0	0	New requirement. Investigating alternative systems.
SHELTER, CO/P, M20/M20A1	4240-01-166-2254	298	111	0	0	
MEDICAL PRODUCTS						
2-PAM CHLORIDE, AUT	6505-01-125-3248	367,876	423,957	0	0	
ATROPINE AUTOINJ	6505-00-926-9083	496,598	642,844	0	0	
CANA	6505-01-274-0951	2,635	2,318	0	0	
PYRIDOSTIGIMINE TAB	6505-01-178-7903	126,607	368,937	0	0	
TETRACYCLINE	NOT AVAIL	28,304	508,220	0	0	

Table 4-5 Marine Corps Logistics Readiness NBC Report Data

NOMENCLATURE	NSN	WAR REQ	STOCKS ON HAND	ON CONTRACT	FY 97	COMMENTS
OVERGARMENTS						
SUIT, CP CAMO (BDO)	8415-01-137-1700-07	0	221,142	0	0	Replaced by JSLIST in FY97
CP, UNDERCOVERALL	8415-01-040-3141	0	350	0	0	Replaced by JSLIST in FY97
SUIT, CP, SARATOGA	8415-01-333-7573-76	1,197,790	641,675	0	0	Replaced by JSLIST in FY 97
OVERBOOTS/GLOVES						
BLK/GRN VINYL O/BOOTS	8430-01-317-3374-85	1,514,373	154,241	0	0	
CP FOOTWEAR COVERS	8430-01-021-5978(L)	277,000	244,873	0	0	Being Replaced by BVO/GVO
CP GLOVES 25 MIL	8415-01-033-3517-20	2,537,009	657,016	0	0	
CB MASKS						
MASK, CB, M17A2	4240-01-143-2017-20	*	13,719	0	0	Replaced by M40
MASK, CB, M40	4240-01-258-0061-63	*	145,038	0	0	
MASK, M24, AVIATOR	4240-00-776-4384(M)	*	2,766	0	0	Replaced by MCU-2/AP
MASK, M25A1, TANK	4240-00-994-8751-52	*	1,034	0	0	Replaced by M42
MASK, M42, TANK	4240-01-258-0064-66	*	6,227	0	0	
MASK, MCU-2/P	4240-01-175-3443	*	0	0	0	
TOTAL MASKS		*277,000**	*168,784*			
MASK COMM ADAPTOR	5996-01-377-9695	50,000	20,000	0	10,000	
MISC PROTECTION						
FILTER CAN, C2	4240-01-119-2315	322,461	314,646	0	0	
FILTER CAN, M10A1	4240-00-127-7186	10,250	3,443	0	0	M24 and M25 masks being replaced
FILTER SET, M13A2	4240-00-165-5026	4,568	29,803	0	0	
HOOD, FOR MCU-2A/P	4240-01-189-9423		87	0	0	
HOOD, M5 (FOR M25)	4240-00-860-8987	2,399	2,399	0	0	Masks being replaced
HOOD, M6A2 (FOR M17)	4240-00-999-0420	32,353	32,353	0	0	Masks being replaced
HOOD, M7 (FOR M24)	4240-00-021-8699	323	323	0	0	Masks being replaced
CHEMICAL DETECTION						
ALARM, CAA, M8A1	6665-01-105-5623	10	30	0	0	
CHEM AGENT MONITOR	6665-01-199-4153	2,700	2,700	0	0	
DET KIT, M256A1	6665-01-133-4964	33,703	3,498	0	0	
DET PAPER, M8	6665-00-050-8529	419,167	7,677	0	0	
DET PAPER, M9	6665-01-049-8982	30,524	9,979	0	0	
DET PAPER, M9	6665-01-226-5589	396,516	28,249	0	0	
ICADS	6665-01-340-1693	28,557	10,000	0	0	
M21 RSCAAL	6665-01-334-6637	197	125	0	0	
NBC MARK SET, M274	9905-12-124-5955	1,704	112	0	0	
NBC RECON SYSTEM	6665-01-323-3582	10	10	0	0	Will be Replaced with Lt/Wt Recon Sys
WATER TEST KIT, M272	6665-01-134-0885	413	129	0	0	

* No individual mask requirement breakout available. A total of 277,000 of the six different masks are currently required.

Table 4-5 Marine Corps Logistics Readiness NBC Report Data (continued)

NOMENCLATURE	NSN	WAR REQ	STOCKS ON HAND	ON CONTRACT	FY 97	COMMENTS
DECONTAMINATION EQUIPMENT						
CALCIUM HYPOCHLORITE	6810-00-255-0471	512	109	0	0	
DECON APPAR, M11	4230-00-720-1618	496,201	19,159	0	0	Requirement is excessive, being recalculated
DECON APPAR, M13	4230-01-133-4124	1,697	11,663	0	0	
DECON APP M17	4230-01-303-5225	722	810	0	0	
DECON KIT, M258A1	4230-01-101-3984	92,256	95,214	0	0	Replaced by M291
DECON KIT, M291	4230-01-276-1905	439,643	120,860	0	0	
DS2, 1 1/3 QT	6850-00-753-4827	992,701	5,416	0	0	Requirement is excessive, being recalculated
DS2, 5 GAL	6850-00-753-4870	1,817	3,229	0	0	Requirement is excessive, being recalculated
PDDA, M12A1	4230-00-926-9488	281	457	0	0	
STB	6850-00-297-6653	1,631	3,142	0	0	
COLLECTIVE PROTECTION						
PCPS	4240-01-346-2564	223	223	0	0	
MEDICAL PRODUCTS						
2-PAM CHLORIDE, AUT	6505-01-125-3248	205,344	205,344	0	0	
ATROPINE AUTOINJ	6505-00-926-9083	291,216	291,216	0	0	
CANA	6505-01-274-0951	93,336	93,336	0	0	
PYRIDOSTIGIMINE TAB	6505-01-178-7903	93,336	93,336	0	0	

APPENDIX 2
FIELDED NBC DEFENSE ITEMS - ISSUES AND CONCERNS

NBC defense items are generally used in combination to form a system or subsystem for a particular function. Therefore, this report will address items used as a system. These systems are categorized into five functional areas.

- Contamination Avoidance
- Individual Protection
- Collective Protection
- Decontamination
- Medical

1. Contamination Avoidance

Contamination Avoidance programs generally include those programs that conduct NBC agent reconnaissance, detection, and identification. This area represents approximately half of the annual DoD NBC defense RDT&E budget. Due to recent type-classification of several modernization programs, this area has a number of moderate risk and high risk programs. As procurements of the Improved Chemical Agent Monitor (ICAM), M21 RSCAAL, and the M93A1 Fox NBC Reconnaissance System continue, this area should improve. This assumes a constant level of funds with respect to past profiles of DoD funding.

The M8A1 Chemical Agent Alarm moved to the high risk category, due to a backlog of orders, the age of the systems, and the M43A1 detector no longer being in production. Deliveries of the new XM-22 Automatic Chemical Agent Alarm Detector (ACADA) (planned production to begin in FY97), supplemented by depot maintenance of older M8A1 alarms, should eliminate the shortages in this critical area over the next five years. The M93A1 NBCRS moved to the low risk category and the ICAM/CAM moved to the moderate risk category based on fill compared to requirement. The fielding of the NDI M31 Biological Integrated Detection System (BIDS) significantly improves the biological detection capabilities of the Army.

The M256A1 Detection Kit remains a high risk due to shelf life status and inventory shortages. Other manual detection materiel, to include M8 and M9 paper, are rated as a low risk.

2. Individual Protection

Currently fielded NBC defense equipment items were primarily designed for use in the European environment against a Soviet threat. Equipment in this functional area provides protection against all known CB threat agents. Past service unique requirements have led to Service-specific procurements and some duplication in capability in this functional area. As a consequence, this has resulted in procurements of six different chemical protective suits and six different masks. In the recent past, this has caused difficulties in meeting Service needs and

exacerbated logistics planning. In FY97, the introduction of the JSLIST protective suits should begin to resolve much of these past difficulties.

The Battle Dress Overgarment (BDO) continues to pose a moderate risk as this item is reaching its maximum extended shelf life limit (14 years), and the Services plan no new production. The Joint Services Lightweight Integrated Suit Technology (JSLIST) Advanced Battle Dress Overgarment (ABDO) and Advanced Chemical Protective Garment (ACPG), respectively, will begin procurement in FY97.

The Services continue modernizing their chemical protective mask inventories. Different versions of the protective mask were developed to meet the requirements of different military occupational specialties (*e.g.*, air crew, tank crew, etc.). For the Army and Marine Corps, the M40 and M42 series masks are replacing the M17 and M25 series masks. The M43 series masks are used in Army Apache equipped aviation units and will be replaced by the M48 mask. These newer masks provide increased protection, improved fit and comfort, and compatibility with most of these Services' weapons systems' optics and sights. Remaining Army aviation units are still equipped with the old M24 mask, which will be obsoleted upon replacement by the M45 mask. The M40 and M42 masks are assessed as low risk; however funding constraints have delayed total replacement of the old masks. The M43 series mask is assessed as moderate risk, but will improve to low risk upon receipt of quantities on contract.

The MCU-2A/P is designed to meet the needs of the Air Force ground crews and Navy shipboard and shore-based support missions.

Battle Dress Overgarment (BDO)

There are no companies currently manufacturing the BDO. The Defense Logistics Agency's largest customer, the Army, has 2.9 million suits on hand in war reserves to sustain its requirements until 1999. The Services are beginning to buy the JSLIST suits, as a replacement for the BDO and other chemical protective suits, beginning in FY97. Related to the BDO, Duro, Inc. is the sole source for the inner layer of the charcoal slurry impregnated fabric (a key capability) used within the BDO suit. DLA presently has an industrial base maintenance contract (IBMC) with Duro to maintain this capability until production of the JSLIST suit can ramp up. This IBMC contract was renewed until September 1997.

Chemical Protective (CP) Gloves

The CP glove is made out of butyl rubber. Butyl rubber is the most cost effective material capable of withstanding all chemical agents with desirable mechanical properties over a wide range of environmental conditions. There are two current producers of the CP gloves—Siebe North, Inc., Charleston, SC, and Guardian Corp., Willard, Ohio. The Services have adequate stocks on-hand for contingency use. Recent DoD surveillance tests have validated the protective qualities of the existing stocks. The health of the Services on-hand inventories has allowed DLA to pursue an IBMC with both current manufacturers to sustain the industrial base

with "War Stopper" funding. The JSLIST program will replace the current glove with an improved glove.

3. Collective Protection

There are two general categories of collective protection: stand-alone shelters and integrated systems. Integrated collective protection equipment is component equipment designed to provide protection against CB agents through the use of filtered air under positive pressure to a variety of facilities, vans, vehicles, aircraft and ships. Collective protection programs continue to be an unsupported program sector. The increased emphasis on individual protection and contamination avoidance programs has resulted in a corresponding decrease in this area. Until the various military users establish a requirement for this capability, this sector will not show signs of improving in the near future. The entire sector is assessed as high risk. Filters for these integrated collective protection systems are in critical supply due to low peacetime demand and low production quantities.

The M51 shelter is being replaced by the new Chemical and Biological Protective Shelter (CBPS), with the M20A1 shelter to be used as an interim replacement; however, the M20 series shelter is assessed as a high risk system due to currently low inventory levels. Continued difficulties in obtaining a strong industry leader in this field compound these problems.

4. Decontamination

Current decontaminants are highly effective against all CB agents, but most present environmental hazards and are manpower intensive. The services are attempting to find environmentally safe decontaminants which are less labor intensive.

The M258A1 Skin Decontamination Kit is the primary item used in personnel decontamination. The replacements for the M258A1 are the M291 Skin Decontamination Kit and the M295 Equipment Decontamination Kit. All three kits are effective against nerve and blister agents, with the M291 and M295 kits relying on a dry resin technology.

The M295 Decontamination Kit is not currently in production. The sole supplier of the resin, Rohm & Haas, Co., sold its mixing and packaging equipment used to manufacture the M291 Kit. They will continue to produce components for the key component, XE-555 resin, after completion of the current contract (scheduled for completion in 1997). Pine Bluff Arsenal, Arkansas, set up a production line and began to manufacture the M291 Kit in October 1996. Rohm & Haas continues to provide the XE-555 resin components. True Tech is blending the components to make the XE-555 resin. Alternatives to produce a different kit that does not use the XE-555 resin are being studied. There are a number of options being explored to retain this "at risk" technology. Although the M291 and M295 would be assessed as high risk, the availability of M258A1 decontamination kits still in the inventory helps steady overall readiness stocks. True Tech will produce the M295 kits in FY97/98.

In the Army, the M12A1 Power-Driven Decontamination Apparatus (PDDA) is the primary piece of equipment in chemical companies used to decontaminate equipment and terrain. The M12A1 is assessed as moderate risk. Although the M12A1 on-hand stocks would result in an assessment as low risk, the maintenance requirements due to the age of this item limits full utilization as a decontamination device. The M17 series Lightweight Decontamination System (LDS), is used to provide operational equipment decontamination in many battalion-level units and dual-purpose (smoke/decontamination) chemical companies. It is assessed as moderate risk due to a low inventory and high demand. This risk should drop as more systems are produced. Basic soldier skills for decontamination of vehicle and crew-served weapons are accomplished using the Portable Decontamination Apparatus, M11, and Decontamination Apparatus, Portable, M13. These are assessed as posing a low risk, based on improved reported inventory for these two items.

5. Medical

Medical NBC defense items are used to counteract the effects of exposure to chemical or biological agents through pre-treatments, vaccines, or post-treatments. Nerve Agent Antidote Kits (NAAK), Convulsant Antidote Nerve Agent (CANA), and Nerve Agent Preventive Pyridostigmine (NAPP) tablets appear to be at high risk due to the Army's Division Ready Brigade Set initiative (see para 4.5) which dramatically reduced the quantities of individual issue items kept on hand at unit level. Active duty Army units are assumed to have their SKO components on hand, as required by Army regulations. Changes in previous inventory figures and FY96 figures are based on year-end reconciliation of stocks at depots, disposal of stocks located at Meridian Medical Technologies (formerly Survival Technology, Incorporated (STI)) that failed extension approval by the Food and Drug Administration (FDA), and increase in stocks due-in to the Army owned account as a result of year-end buys.

The sole supplier to DoD for nerve agent antidote kits is Meridian Medical Technologies whose manufacturing plant is located in St. Louis, Missouri. Although Meridian is a U.S. company, both the atropine and pralidoxime chloride drugs used to fill autoinjectors are obtained from German suppliers. Currently, there are no domestic sources for these drugs.

The U.S. Army Medical Materiel Development Agency (USAMMDA) added Meridian to their New Drug Application (NDA) for producing the Convulsant Antidote, Nerve Agent (CANA) autoinjector. The Army continues to requisition CANA from the Defense Personnel Support Center to replenish and maintain stocks, and to support the industrial base. Meridian's nerve agent antidote production line is being maintained with an industrial base maintenance contract (IBMC). USAMMDA's centralized management initiative for medical chemical defense materiel should also aid in maintaining the health of Meridian's line. The shelf-life extension for nerve agent antidote kits is part of this initiative and will help keep Meridian viable.

Medical research continues to explore medical countermeasures to deter, constrain, and defeat the use of biological warfare agents against U.S. forces. The Medical Biological Defense Research Program (MBDRP) was established to develop medical countermeasures against validated biological agent threats. These medical products transition from research programs to

the Joint Program Office for Biological Defense (JPO-BD) for acquisition management. JPO-BD is currently developing a request for proposal for a prime systems integration contract for the development, FDA licensure, and production of vaccines.

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CHAPTER 5

NUCLEAR, BIOLOGICAL, AND CHEMICAL DEFENSE READINESS AND TRAINING

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5.1 INTRODUCTION

For weapons of mass destruction (WMD) to provide a military advantage, they must produce adverse physical or psychological effects and degrade performance of an opponent's force. Performance degradation could be achieved by causing mass casualties, damaging material, or simply forcing personnel into a protective posture which reduces their ability to perform. If these weapons do not ultimately result in mission degradation, an adversary may be deterred from employing WMD. A force trained, equipped, and demonstrating the ability to survive, fight, and win in a battlespace where WMD are used, continues to be a critical element of deterrence.

The Services have done well in the exercise of their NBC defense responsibilities under Title X of the FY94 Defense Authorization Act. Our vision for Joint NBC Defense Management follows: **America's Armed Forces trained and ready for the 21st Century, protecting our nation and its forces against nuclear, biological and chemical threats.** We will build on the Service successes to develop a viable Joint orientation to NBC defense capabilities which includes Joint requirements documents; Joint doctrine and tactics, techniques, and procedures; Joint modeling, simulation and wargaming; and Joint professional training. The counter-proliferation acquisition initiative has provided funding necessary to begin this process under the new management of the Joint Services Integration Group (JSIG) discussed in Chapter 1.

5.2 JOINT NBC DEFENSE DOCTRINE

The scope of Joint Pub 3-11, *Joint Doctrine for Nuclear, Biological, and Chemical (NBC) Defense*, includes providing guidelines for the planning and execution of NBC operations. Its focus is on the NBC threat; national policy; and considerations peculiar to the preparation and conduct of NBC defense. These considerations include principles of theater NBC defense, logistics support, medical support, training, and readiness. Although NBC defense doctrine is briefly addressed in 29 other joint doctrine publications further development may be required, particularly in the area of joint tactics, techniques, and procedures. In the meantime, Joint Pub 3-11, in conjunction with CJCS CONPLAN 0400-96, provides a foundation for combatant commands to train and evaluate their forces.

5.2.1 Joint NBC Defense Doctrine Program Management

The NBC defense program management strategy described in Chapter 1 provides the mechanism to provide assistance to the Joint Staff in the further development of Joint NBC defense doctrine program. The Joint Service Integration Group (JSIG) has begun coordinating with the Services to ensure the program is realistic and meets the needs of the Joint community.

5.2.2 Joint NBC Defense Doctrine Development Program

The FY95 effort consisted of several initiatives to analyze and develop a requirements list for NBC defense doctrine programs that will be used to develop a strategy for recommending changes to the next generation of Joint NBC defense doctrine. Work began on a

multi-year NBC Defense Joint Doctrine Development Action Plan (JDDAP) that will serve as a road map for these recommended changes. The draft doctrine emerging from this process will be validated using simulations and then used to recommend a revision of Joint Pub 3-11, where appropriate.

During FY96, manning of a five member U. S. Army Chemical School (USACMLS) Joint Doctrine Cell was completed. This cell, however, was not manned until September because of the prolonged civilian hiring procedure. Also in FY96, a contract was awarded to perform the Service doctrine and open publication literature search, and to develop a data base and library to be used in preparing the JDDAP. This effort will identify existing doctrine, tactics, techniques and procedures used by the Services; correlate areas of commonality; identify voids; and ultimately prepare the road map (JDDAP) for joint doctrine efforts. Reference material has been delivered to the USACMLS. An In-process Program Review (IPR) is to be scheduled at which time initial recommendations for the JDDAP will be presented to the USACMLS. Coordination with other Services is to be scheduled. The FY96 effort was hampered by late funding (received in March 95) and lack of personnel.

5.2.3 Army Medical Doctrine Development Program

The FY96 effort consisted of several initiatives to update AMEDD NBC defense doctrine products and develop coalition medical NBC procedures. Two AMEDD doctrine field manuals were updated. They were FM 8-9 (NATO Handbook on the Medical Aspects of NBC Defensive Operations AMedP-6(B)) and FM 8-285 (Treatment of Chemical Agent Casualties and Conventional Military Chemical Injuries). FM 8-9 and FM 8-285 are multi-service publications.

The AMEDD participated in numerous NATO medical NBC procedural products development resulting in several NATO Standardization Agreements (STANAGs). Further, the AMEDD participated in Quadripartite Working Group to develop additional medical NBC procedural product agreements (QSTAGs). STANAGs and QSTAGs are reviewed for integration of these agreements into Army-specific doctrine literature publications.

A new AMEDD doctrine literature publication provides medical management and treatment procedures for biological warfare agents is in the early planning stage. This manual will most likely become a multi-service publication.

5.3 STANDARDS/PROFICIENCY AND CURRENCY

Each service establishes standards of proficiency and currency for NBC defense training. The U.S. Army Chemical School (USACMLS) as the DoD Executive Agent for joint NBC defense training, has initiated several actions to counter NBC threats. These include (1) assisting CINCs, MACOMS and their staffs assessing and providing reference materials regarding the NBC threat and recommend actions to reduce the NBC threat in their areas of operations; (2) providing broad-based joint NBC defense doctrine and joint doctrine development support; (3) introducing and upgrading instructional aids and training support

material for war colleges and command and staff colleges for all services; and (4) developing, evaluating, and fielding advanced distributed instructional capabilities for both resident and nonresident instruction.

5.3.1 Army

Army Regulation 350-41, *Training and Units*, establishes Army standards for proficiency for NBC defense training. NBC defense training is conducted at schools and in units.

Individual Training

At the initial training level, NBC defense tasks are taught to students wearing Mission Oriented Protective Posture (MOPP) gear during Basic Soldier Training and Warrant Officer Candidate Training to satisfy Military Qualifications Standards Level I. Qualification Standards Level II is achieved from NBC tasks training conducted during Officer (basic and advanced) and Warrant Officer (basic) training. NCOs train on leader NBC skills during Primary Leadership Development Courses (PLDC). Other Officer and NCO courses require training in NBC effects on AirLand operations. At the company level each unit has an NBC NCO specialist and at the battalion or higher level each unit has an NBC Officer and Senior NCO.

Unit Training

The Army is constantly challenged to improve its training of NBC battlefield hazards by integrating such training into unit mission training as well as individual and leader training. It is required that the NBC protective mask be worn during weapons qualification training up to twice a year, depending on the unit category within the Standards in Training Commission (STRAC). Additionally, essential Army civilians are trained in NBC survival skills. Because of today's battlefield complexities, the Army takes a systems approach to its training. NBC tasks for individuals are published in Soldiers' Training Publications and trained in the Army School System. Sustainment training occurs in the unit. NBC collective tasks are published in ARTEP Mission Training Plans. The highest level of NBC training recognizes NBC as a battlefield condition and units train to execute their mission-essential task list (METL) while under NBC conditions.

Mobilization Training

Fort McClellan is a major Reserve Component mobilization center for chemical units. As part of the mobilization process, these units receive individual and unit NBC defense refresher training. During Desert Shield/Storm, instructor personnel from the U.S. Army Chemical School trained numerous units to ensure currency in NBC tasks prior to deployment.

Medical Training

The U.S. Army Medical Department Center and School (AMEDDC&S) conducts Medical NBC Defense Professional Training at Fort Sam Houston, Texas consisting of four

Soldier/Noncommissioned Officer (NCO) courses, two Officer courses and various related professional short courses.

AMEDD sergeants attend a 17 week Basic NCO Course (BNCOC) where NCOs with the MOS 91B (combat medic) are trained to be medical platoon treatment/evacuation team leaders. AMEDD BNCOC provides the NCO with the technical and tactical skills to conduct medical operations in a NBC environment, to manage and treat contaminated casualties, and to train non-medical soldiers in casualty decontamination procedures. In FY96, more than 350 junior NCOs were trained in this course.

All AMEDD officers begin training in the Officer Basic Course (OBC). This 11 week course prepares them with the fundamental knowledge to conduct medical operations in an NBC environment and to advise company, battalion, and medical treatment facility commanders in NBC contamination avoidance and the medical implication of NBC exposures. This experience includes a mixture of classroom instruction, field training exercises and confidence building, hands-on equipment training. There are six courses for active Army components and five courses for Reserve/National Guard components annually. In FY96, over 1,800 officers were trained in these courses.

The AMEDD Officer Advance Course (OAC) is designed to provide advanced military education for officers with 3–9 years of time in service. This 19 week course provides the AMEDD officer for command, leadership, and staff positions of greater responsibility in both peacetime and times of hostility. Medical NBC training emphasis is placed on supervision of medical operations in NBC contaminated environments with a capstone, Corps level, field training exercise, Medical Unit Staffs in Operations. Due to restructuring of this course for FY97, there was only one course offered to each of the active Army and Reserve/National Guard component. In FY96, more than 700 company grade officers were trained in these courses.

The Medical Management of Biological and Chemically Contaminated Casualties (M2BC3) Course provides DoD personnel, primarily physicians and nurses, with a working knowledge of the potential threat of chemical and biological weapons and the status and scope of medical defense strategies. It combines classroom instruction and a field experience to establish essential skills, install confidence and define limitations in therapeutic modalities with each type of medical setting. The course also instructs on the use of specialized equipment and skills required for safe, long-distance evacuation. First-hand experience in triage, decontamination and medical operations on the integrated battlefield is stressed. This course is offered four times annually at the U.S. Army Medical Research Institute for Chemical Defense (MRICD), Aberdeen Proving Grounds, Maryland and the U.S. Army Medical Research Institute of Infectious Diseases (USAMRIID), Ft. Detrick, Maryland. along with a shorter "road" course provided on-site for individual units or posts. Additionally, M2BC3 was presented to the Medical Corps specific OBC class as part of their initial training to the AMEDD. In FY96, there were 793 Army, 168 Navy, 30 Air Force, 156 DoD Civilians/National Guard/Reserve, and 650 Civilians (Atlanta fire, police, and EMT) personnel trained in this course, for a total of 1,797 personnel. A broadcast course presenting the Medical Management of Biological Casualties is

being prepared and will be presented via video teleconference to multiple sites beginning September 1997.

Specific nuclear training is addressed through the Medical Effects of Nuclear Weapons (MENW) course. This one week course is designed to provide military health care providers and operational planners with background material relating to human injury and combat effectiveness in a nuclear weapons detonation or accident scenario. The course introduces the physical principles of nuclear weapons and ionizing radiation effects and investigates the medical problems associated with radiation, including external exposure and internal contamination. This course is offered twice annually at the Armed Forces Radiology Research Institute (AFRRI), Bethesda, Maryland along with shorter "road" courses provided on-site for individual units or posts. MENW was also presented to the Medical Corps specific OBC class as part of their initial training to the AMEDD. In FY96, there were 433 Army, 122 Navy, 165 Air Force, and 9 DoD Civilians personnel trained in this course, for a total of 729 personnel.

The Medical NBC Professional Filler (PROFIS) Course is a two week, Joint Service, course for the Medical NBC Officer (Nuclear Medical Science Officer or Preventive Medicine Officer) which stresses advanced instruction on the medical implications of NBC and directed energy environments. Topics range from the medical threat of NBC to the structure of the Wartime AMEDD and are presented by subject matter experts from various DoD and Civilian agencies, such as the USACMLS, AFRRI, Defense Intelligence Agency, and Scientific Ecology Group, Inc. Emphasis is placed on contingency operations, lessons learned from previous deployments, and responsibilities of PROFIS Officers to their wartime units. In addition, each officer receives a "Battle Chest". This chest contains a notebook computer with modem, color printer, and digital references. The Battle Chest gives each officer the ability to perform their medical NBC duties in any deployable region.

Shortfalls in medical NBC simulations were addressed in FY96. There were two extensive initiatives started to train AMEDD officers in medical NBC, logistical, and operational knowledge. In the stand alone simulation, each officer will be placed in a virtual scenario in which they need to react in "real-time" to the operational tempo of the ongoing virtual battle. The long term goal of this simulation endeavor is to be incorporated, whether conceptually or entirely, into the WARSIM 2000 effort. Additionally, enhancements started with existing simulations stressing the management of NBC contaminated casualties with an Observer/Controller on site to evaluate the thoroughness of decontamination procedures.

A new initiative, Medical NBC Defense Training and Education Network, established a method to provide distributed learning and digital references via the Internet to improve the overall awareness of medical NBC issues and to enhance sustainment, training capabilities. The "home page" [http://www.nbc-med.org/] provides doctrinal publications that are inter-connected by keywords to allow for quick searches of topics. For training purposes, the user can download these documents. In addition to the internal search capability, this site has a state of the art, Internet search engine which allows the user to explore all electronic information in support of medical or NBC training. Training using multimedia technology is also being developed for use with this network. Currently, a Management of Chemical Warfare Injuries

interactive training package and Medical Management of Biological Casualties Manual is accessible through the site with nuclear training to be added as they become available. Future improvements to this network include: expanding connectivity to other military, governmental and private agencies; scheduling interactive training and education events; and adding related video, video conferences and training seminars to enhance training.

5.3.2 Air Force

Air Force policy is to train and equip only personnel in or deployable to NBC threat areas. The Air Force standards of proficiency are based on two international standardization agreements: NATO Standardization Agreement 2150 (NATO Standards of Proficiency for NBC Defense), and Air Standardization Coordinating Committee (ASCC) Air Standard 84/8 (Initial, Continuation and Unit NBC Standards). Both agreements are implemented through Air Force Instruction 32-4001, Disaster Preparedness Planning and Operations. The Air Force ensures proficiencies and currency of NBC warfare defense training through classroom training, unit level training, and exercises. NBC Defense Training (NBCDT) is required only for military personnel and emergency essential civilians in or deployable to areas where the use of biological or chemical weapons are threatened. Major Commands (MAJCOMs), the Air Reserve Component, and Direct Reporting Units may tailor their NBCDT programs to meet their specific mission requirements. The subjects presented in the classroom follow the three principles of NBC defense (avoidance, protection and decontamination) as identified in Joint Doctrine. The classroom training is followed by unit level training on wartime mission critical tasks. Supervisors train personnel to complete mission critical tasks while the workers are wearing their full complement of individual protective equipment. Exercises are used for training and evaluation purposes. Instructors at unit level receive their professional training through Air Force courses at Ft. McClellan, Alabama.

Individual Training

There are two types of individual training. The first is *general equipment and procedures training* that enables personnel to recognize and protect themselves and others from NBC hazards. The second is *individual proficiency training* that enables personnel to perform their wartime tasks in a NBC contaminated environment. Detailed training comes with assignment to a threat area or to a deployable unit. Personnel receive six hours of initial equipment and procedures training to include mask confidence training within 30 days after arrival in a threat area or 90 days after assignment to a mobility position. NBC refresher training is at the discretion of the major commands, with the majority opting for annual refresher training through classroom training and exercise participation. Individual NBC proficiency training occurs through on-the-job-training and exercise participation.

Unit Training

Units in or deployable to threat areas must conduct at least two attack response exercises per year; overseas units often conduct graded attack response exercises more frequently. Air Force major commands have reported significant increases over the last three

years in the number of people receiving equipment and procedures training as well as the number of hours spent for that training. The Air Force requires installations to conduct graded attack response exercises, consistent with the threat, at least:

- twice annually at installations in NBC threat areas
- once annually at installations in NBC non-threat areas
- An additional exercise for units with a mobility commitment based on the threat within the deployment area.

5.3.3 Navy

The Navy's standards of proficiency are contained in several publications:

NWP 62.1	Surface Ship Survivability (Series)
NSTM 470	Shipboard BW/CW Defense
NSTM 070	Radiological Recovery of Ships After Nuclear Weapons Explosion
NSTM 077	Personnel Protection Equipment
FXP-4	Mobility, Logistics, Fleet Support Operations, Non-Combat Operations and Explosive Ordinance Disposal Exercises
S 5080	US Navy Chemical/Biological Defense AA-HBK-010 Handbook

Individual Training

The Navy provides initial entry level CBR defense training to all officers and enlisted personnel in the accession programs. Enlisted personnel receive three hours of training (2 hours in the classroom; 1 hour in the lab) focused on the use of personal protection equipment and survival skills, including a CBR-D "confidence" chamber exposure. Officers receive two hours of class time focused on personal protection equipment and survival skills.

Unit Training

Proficiency training is conducted at the unit level by Navy instructors who are graduates of the NBC Defense course conducted by the Navy at Fort McClellan, Alabama. Navy units receive formal training prior to and during deployment. In addition to training, graded exercises are conducted semi-annually.

5.3.4 Marine Corps

The Marine Corps' NBC training focuses on the ability to conduct operation throughout the battlespace with particular emphasis on amphibious deployment, littoral, and air/ground operations. The Marine Corps views NBC as an environment, similar to daylight/darkness, cold/heat.

Training requirements are derived from the Force Commander's Mission Essential Task Lists, Joint Universal Lessons Learned, Marine Corps Lessons Learned, Mission Need

Statements and Fleet Operational Needs Statements. Once validated, the training requirements are introduced into the Systems Approach to Training (SAT) Process.

One of the results of the SAT process is the development of Training Tasks and Standards that will fulfill the training requirements. These tasks lists and standards are incorporated into Individual Training Standards (ITSs) for individual Marines and Mission Performance Standards (MPS) for Marine units. These ITSs and MPSs are published as Marine Corps Orders for standardization and compliance throughout the Marine Corps.

The Marine Corps breaks training down into two categories: Individual Training based on ITSs and Collective (unit) Training based on MPS. Figure 5-1 shows the individual NBC training provided to all Marines both enlisted and officers.

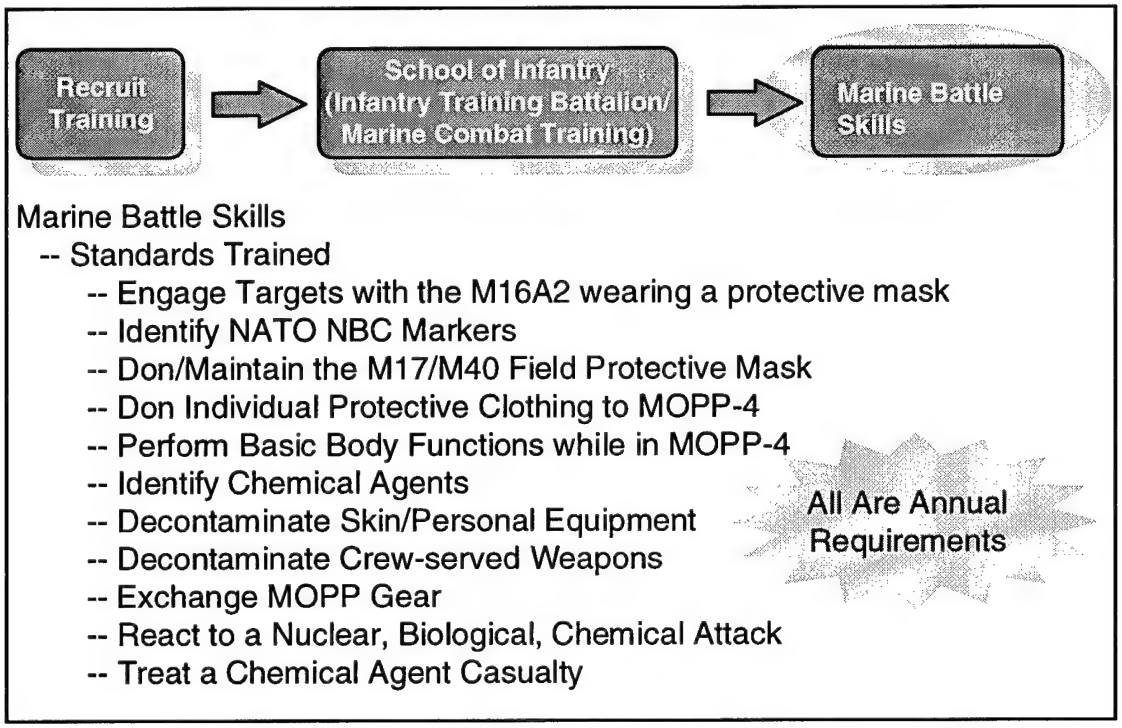

Figure 5-1. USMC Individual NBC Training (Enlisted)

Individual Training

Enlisted entry level training begins at recruit training or "Boot Camp" where marines are introduced to the field protective mask and the gas chamber. All enlisted marines then proceed to the School of Infantry (SOI). NBC training is identical for all personnel. The training focus is surviving under NBC conditions. Training is currently transitioning from a classroom/academic environment to practical application/field environment to provide students more hands on experience.

Once Marines reach their units they begin the Marine Battle Skills program. Marine Battle Skills is a set of tasks which all Marines are required to be proficient in and are evaluated

on annually. Marine Battle Skills NBC training focuses on providing marines the capability to survive as well as function under NBC conditions.

Unit Training

Unit level (or collective) training includes classroom and field training and is included in unit training exercises and plans. (See figure 5-2.) Just as individuals are required to meet ITSs, units are also required to meet very specific training standards. These requirements take the form of Mission Performance Standards (MPSs). Each type of unit in the Marine Corps has a set of MPS assigned to it. These MPSs are published as 3500 Series Marine Corps Orders.

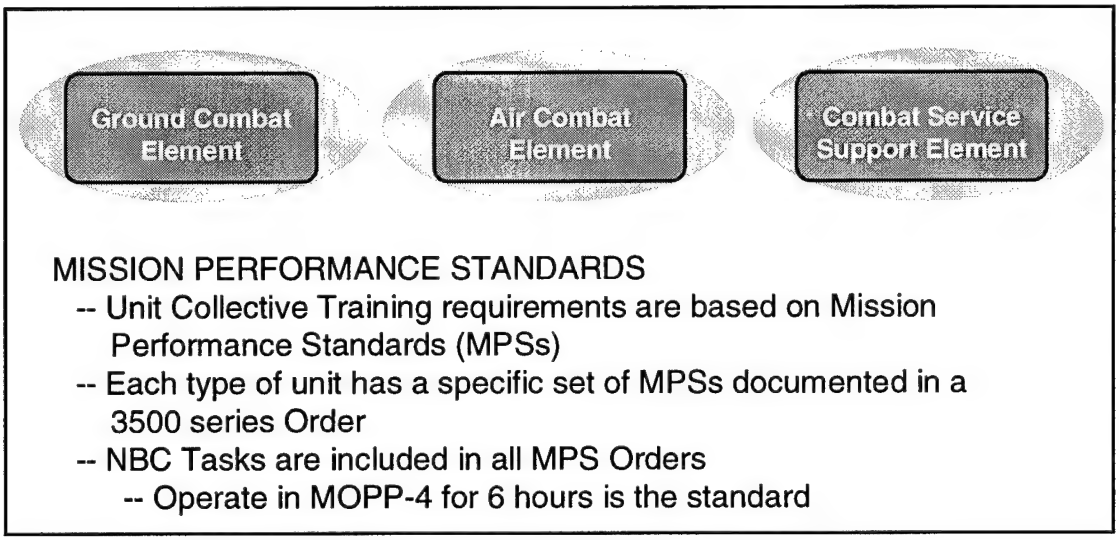

Figure 5-2. USMC Collective Training, NBC Requirements

Each MPS Order includes NBC Tasks which the unit must accomplish. However, each set of requirements varies from unit to unit. For example, a Tank Battalion must be able to utilize the vehicle's NBC filtration system, decontaminate tanks, and operate tanks under NBC conditions. An Infantry Battalion on the other hand has no requirement to decontaminate tanks, but does have to decontaminate crew served weapons. Unit NBC defense training is overseen by unit NBC specialists who are graduates of the Army's Chemical Defense Training Facility at Ft. McClellan, Alabama. (See figure 5-3.) NBC evaluations are conducted annually for all Marine Corps units. Those units that are part of the Marine Corps' Unit Deployment Program and designated Marine Expeditionary Units are required to undergo an NBC evaluation prior to deployment.

5.4 NBC DEFENSE PROFESSIONAL TRAINING

Public Law 103-160 requires all Services to conduct NBC defense professional training at the same location. Currently, training is located at the U.S. Army Chemical School, Fort McClellan, Alabama. Each Service conducts their training with their own Service instructors. The experts who graduate from the Service's technical training and the Army's Chemical Defense Training Facility become instructors for their Service's unit training.

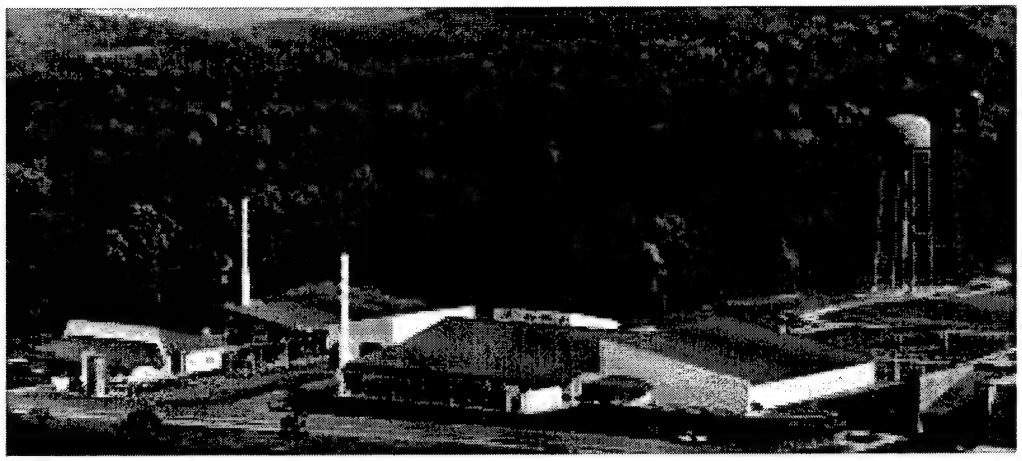

Figure 5-3. Chemical Defense Training Facility, Fort McClellan, Alabama

5.4.1 Joint NBC Defense Professional Training

The U.S. Army Chemical School has established a Joint Training Steering Group (JTSG) as a forum to discuss issues that pertain to facilities and range scheduling and any other training issues that impact the ability of the Services to conduct effective training.

Plans are being made to exchange information on Service equipment, doctrine and employment techniques to establish a baseline for development of future Joint doctrine and professional training. The discussion concerning a Joint instructor pool is beginning. The concept is to consolidate classes that teach the same task to the Services using a Service instructor that has that skill. Conceivably, a Marine Corps instructor could teach a task to a class containing Army, Navy, Marine Corps, and Air Force students. For example, the Air Force now teaches a four-day block of instruction for the Navy concerning major accident response. This exchange will grow once the JSIG is staffed and funded to coordinate the effort.

Within the joint medical arena, a new course, "The Management of Chemical and Biological Casualties Course", has been established based on guidance contained in DoD Directive 6025.3, Clinical Quality Management Program in the Military Health Services (signed 20 July 1995). This directive requires that health care providers receive certification that documents preparation for assignments during military operations. This includes NBC defense training and provider courses where applicable. Certification will be reviewed by the medical commander annually. In addition, on 20 December 1995 the DoD completed a Directive "Military Medical Readiness Skill Training" (number to be assigned) which implements policy, assigns responsibility, and prescribes procedures for developing and sustaining comprehensive systems for providing, assessing, and monitoring military medical skills training essential for all military personnel, health care personnel, and medical units. NBC defense training, to include chemical and biological warfare defense measures and medical specialty training such as casualty management, are specifically articulated in the instruction.

All medical professional emergency medical preparedness Medical Nuclear Casualty Training has been consolidated under the Armed Forces Radiobiology Research Institute in Bethesda, Maryland, where radiobiology education is made available in a Tri-Service format.

5.4.2 Army NBC Defense Professional Training

US Army NBC Defense Professional Training at Fort McClellan, Alabama consists of three enlisted/noncommissioned officer courses and two officer courses. Initial entry enlisted soldiers receive training in agent characteristics and hazards, smoke and decontamination operations, chemical and radiological survey procedures and individual protective clothing and equipment. This one station unit training program provides 18 weeks of intensive training. It culminates with live/toxic agent training in the Chemical Defense Training Facility. Toxic agent training is an integral, mandatory component of all professional courses.

Chemical Corps sergeants attend the 15 week Chemical Basic Noncommissioned Officer Course (BNCOC) where they are trained to be an NBC company squad leader and a non-chemical company or battalion NBC NCO. Chemical BNCOC provides the NCO with the technical and tactical skills needed to advise company/battalion commanders in NBC operations and procedures, to train non-chemical soldiers in NBC avoidance, decontamination and protective measures and to lead smoke/decontamination squads.

Chemical Corps staff sergeants and sergeants first class attend the 13 week Chemical Advanced NCO Course (ANCOC) where they are trained to be an NBC platoon sergeant, an NBC NCO at brigade level, and an NBC NCO in a division or Corps level NBC element. They receive advanced technical operations, hazard estimates, logistics and maintenance management, combined arms operations, smoke and flame support, and training management.

Chemical Corps lieutenants attend a 19 week officer basic course which prepares them to serve either as a Chemical Corps smoke or decontamination platoon leader or as a non-chemical battalion chemical staff officer/assistant operations officer. This course provides them with a fundamental knowledge of NBC agent characteristics and hazards, NBC recon (non-FOX), decon and smoke operations, NBC staff functions, and individual/unit tactical operations. The course is a mixture of classroom instruction, hands-on equipment training, and field exercises. Completion of live/toxic agent training is a prerequisite for graduation.

Chemical Corps captains attend the 20 week officer advanced course where they are trained to serve as the commander of an NBC defense company and as NBC staff officers at the brigade and division level. Instruction focuses on leadership, Army operations, hazard prediction, planning and conducting NBC reconnaissance, decontamination, and smoke and flame operations in support of maneuver units. Additionally, officers receive training in nuclear target analysis/vulnerability analysis, operational radiological safety, and environmental management. Extensive use is made of computer simulations to reinforce the application of NBC assets in support of tactical operations.

Specialized professional training is conducted in stand-alone courses attended by DoD, Allied, and international students. These courses include:

- NBC Reconnaissance Operations (FOX) (5 weeks)
- Radiological Safety (Installation level) (3 weeks)
- Chemical Weapons Inspector/Escort (OSIA) (1 week)
- Chemical Weapons Convention Module II (6 weeks)
- Decon Procedures (Non-US) (GE, UK, NE) (1 week)
- RADIAC Calibrator Custodian (1 week)
- Biological Detection Specialist (7 weeks)

5.4.3 Air Force NBC Defense Professional Training

The Air Force training detachment at Ft. McClellan offers seven separate in-residence courses designed to enhance the NBC proficiency of primary-duty AF Civil Engineer Readiness Flight personnel. These courses fulfill the differing needs of the total force, including Active Duty, Air National Guard, and Air Force Reserve. Further, the Air Force administers an exportable course designed to prepare people for in-residence training, a career development course taken through correspondence, and two mobile courses in airbase operability and NBC cell operations.

Each course contains a wide range of materials; covering critical aspects of Readiness Flight operations in situations ranging from peacetime, military operations other than war, through wartime. The following is a synopsis of the NBC aspects of these courses.

- Training for personnel being assigned primary readiness duties includes comprehensive coverage of agent characteristics and hazards (to include determination of incapacitation/ lethality levels); nuclear weapons effects and other specific hazards associated with ionizing radiation; NBC detection and decontamination; contamination control and avoidance techniques; plotting and reporting procedures; detailed NBC persistency and duration of hazard calculations; the inter-relationship between NBC defense and other passive defense activities (*e.g.*, camouflage, concealment, and deception, (CCD), dispersal, and hardening, *etc.*); and systematic analysis procedures for assessing the hazard and providing credible advice to commanders.

- Air Force learning theory emphasizes hands-on training and the school makes extensive use of available training ranges and equipment. The school includes CDTF live agent training in most of their courses. Training is provided on every major piece of equipment available in the field today, including state-of-the-art items to be fielded in the near future.

- The Readiness Flight Officer and 7-level Craftsman courses provide flight leaders and mid-level NCOs with the background and technical information that is necessary for effective management of the Readiness Flight and contingency response operations.

Readiness is the key to successful Air Force operations. Consequently, the various aspects of Readiness Flight operations, including NBC defense, are also topics of instruction at briefings for Air War College, Air Force Institute of Technology, or Joint Senior Leaders Courses.

5.4.4 Navy CBR Defense Professional Training

The Navy Training Center Detachment at Fort McClellan offers two courses of instruction for Navy Chemical, Biological and Radiological Defense (CBR-D) specialists. The courses are open to Navy, Coast Guard, Military Sealift Command and foreign personnel, E-5 and above. Courses are designed to provide both afloat and ashore commands with individuals who can successfully perform their requisite duties in a CBR contaminated environment. In addition, the training enables CBR-D specialists to act as the primary CBR-D trainers for their respective commands.

The training capitalizes on the unique capabilities of the Army Chemical School. In addition to classroom instruction, the Navy Detachment utilizes the CDTF for live agent training and the Bradley Radiological/Laser Laboratory for training in theory and equipment operation for radiological defense. Approximately 500 students graduate annually from the Detachment's courses. In addition to being fully qualified to conduct training using the Army's facilities, the Navy Detachment actively participates as part of the Joint Training Steering Group.

CBR-D training is incorporated into other courses such as the Senior Enlisted DC Program Management and Training, Damage Control Assistant, Repair Party Leader, and Explosive Ordnance Disposal.

5.4.5 Marine Corps NBC Defense Professional Training

The Marine Corps NBC Defense School at Ft. McClellan consists of an Enlisted Basic NBC Defense Course, and a newly developed Officer Basic NBC Defense Course. In addition to the courses conducted by the Marine Corps NBC Defense School, marines attend three other functional courses (Chemical Officer Advanced Course, NBC Reconnaissance Course, and the Radiological Safety Officer Course) conducted by the Army Chemical School.

The USMC Enlisted Basic NBC Defense Course trains approximately 200 NBC specialists in a comprehensive 10 week program covering all the Individual Training Standards specified in MCO 1510.71. The curriculum includes 108 hours of instruction on how to conduct NBC training. This training provides marines with the tools they will need on a daily basis as they perform their primary peacetime mission of conducting NBC Defense training to their units. The course is divided into six blocks of instruction as shown in figure 5-4.

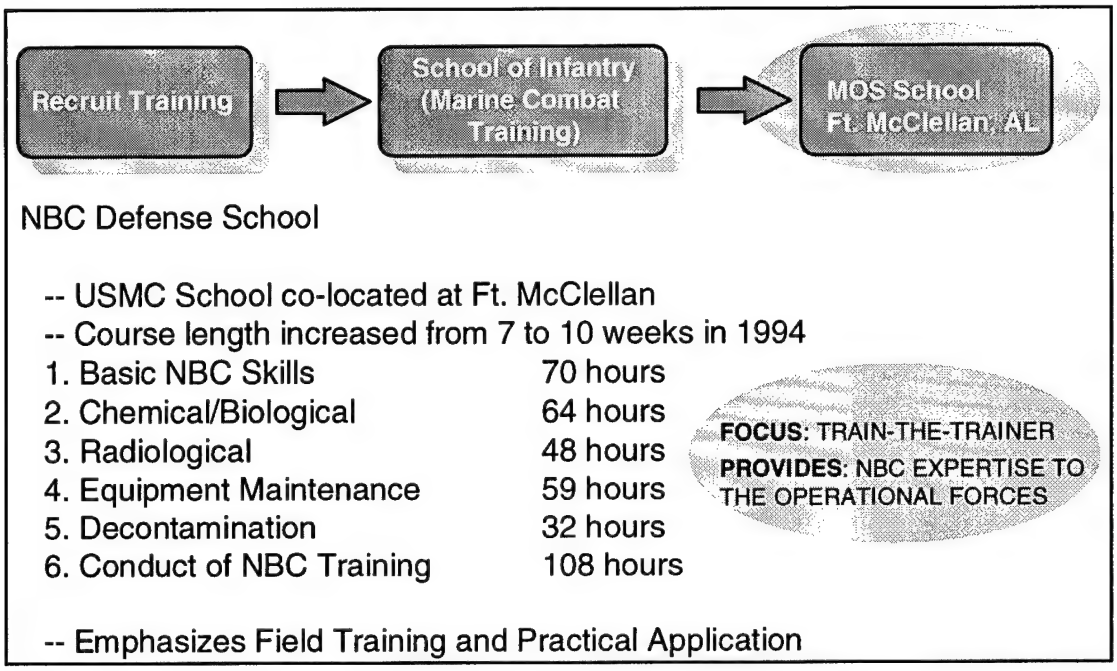

Figure 5-4. USMC Individual Training (Enlisted NBC Specialists)

The USMC Officer Basic NBC Defense Course will be scheduled once a year to coincide with the graduation of newly selected warrant officers from the Warrant Officer Basic Course. The first iteration will be conducted in June 1997. The seven-week course will train about 24 students annually and provide instruction on all officer training standards specified in MCO 1510.71.

5.5 TRAINING IN A TOXIC CHEMICAL ENVIRONMENT

In 1987 the Army established the Chemical Defense Training Facility (CDTF) at Fort McClellan, Alabama. The CDTF allows personnel to train in a real toxic agent environment. Since its opening, the Army has utilized this valuable resource to train over 36,000 US and Allied members from all Services. Training philosophy demands that the military train the way it fights. The CDTF promotes readiness by providing realistic training in the areas of detection, identification, and decontamination of chemical agents. The training develops confidence in chemical defense tactics, techniques, procedures, and chemical defense equipment. Instructors ensure that trainees can adequately perform selected tasks on a chemically contaminated battlefield. To date, the CDTF has maintained a perfect safety and environmental record.

Enrollment at the Joint Senior Leaders Course and the Toxic Agent Leader Training Course at Fort McClellan continues to be in demand. However, due to funding constraints, both of these courses were deleted from course listings during the Training and Doctrine Command FY96 Course Review. The Joint Senior Leader Course continues as an unresourced course and units requesting Toxic Agent Training are accommodated if funding can be arranged. Over 1,200 active and reserve commanders, service leaders, and toxic agent handlers from each of the services have attended. These experts become instructors for the Services for unit training. In

addition to this training opportunity, toxic chemical environment training provides senior officers, commanders and future specialists confidence in their doctrine, warfighting techniques, and the equipment they fight with in the face of challenges presented by NBC contamination. Without this capability, training for all personnel would be theoretical, with no practical experience in a toxic environment.

There is growing international interest in CDTF training participation. Germany has been taking advantage of this training opportunity for about five years. The United Kingdom now uses this facility for training. Law enforcement agencies have also participated in the training.

During FY95, the Base Realignment and Closure Commission (BRAC) placed Ft. McClellan on the base closure list and is planned for closure in FY99. The Chemical School and the CDTF will be closed and new training facilities are planned to be opened at Fort Leonard Wood, Missouri.

5.6 INTEGRATION OF REALISM/WARGAMES/EXERCISES

5.6.1 Simulations and Wargames

Incorporation of NBC features into relevant simulations, including portrayal of NBC weapons effects is essential. Currently, several models which represent the fluid dynamics of NBC contamination are available. However, relatively few robust representations of NBC effects have been fully implemented in wargames and analytical models used by DoD. The Concepts Evaluation Model (CEM), used by the Army Concepts Analysis Agency, captures NBC effects off-line. Corps level models such as Vector-In-Command (VIC) and Division models such as Combined Arms and Support Task Force Evaluation Model (CASTFOREM) have some NBC capabilities and are continually being improved. JANUS, a division level model, has NBC capabilities that are being improved and updated. Force Evaluation Model (FORCEM) has been modified for theater level play. The configuration controlled version of Tactical Warfare (TACWAR) has had within it a chemical module for theater level chemical play that is under examination by the Joint Staff, and OSD for its ability to accurately model the effects of chemicals on a theater level warfight.

Incorporation of WMD features in relevant models, including faithful portrayal of CB aerosolization and electromagnetic pulse (EMP) effects is essential. The incorporation of CB weapons into the base cases of the computer wargame Louisiana Maneuvers (LAM) versions of the combat development and training model Janus-A and the ongoing iteration of the Army's Total Army Analysis (TAA) process using FORCEM, mark the first time major decisions have considered CB weapons as a part of the standard battlefield. For the LAM Janus-A (CB), the next step is to adopt the CB improvements into the Army Standard Janus-A model. This will put CB effects into a widely used training simulation and provide a Janus-A training audience the opportunity to understand the impacts of CB weapons. ACES, an Air Force Command Exercise System is a family of joint wargames which currently has robust nuclear simulations with chemical and biological planned for the near future. All existing models need to be modified in

the biological area. To date, there has been limited model modification for biological play except for the current modifications ongoing to Janus.

Each of the services conducts wargames, which incorporate WMD in the scenarios, in their respective senior level service schools. The Joint Land, Aerospace, and Sea Simulation (JLAS), a joint exercise with all the senior service schools participating, hosted by the Air Force Wargaming Center at Maxwell AFB, Alabama, incorporates electronic simulation of the NBC environment. The Navy has conducted a Naval Battle Analysis to provide a tool to analyze the effects of CB agents on Naval operations and permit the incorporation of realistic assessments of CB warfare effects into Naval wargames. As a result, the Vapor, Liquid, and Solid Tracking (VLSTRACK) Model has been integrated into selected wargames and demonstrated to participants.

The current gaming simulations (*e.g.*, Corps Battle Simulation and Brigade/Battalion Battle Simulation) do not provide commanders and staffs with the tools that will enhance their ability to manage a battle fought under NBC and smoke conditions. The fix for these legacy systems is through upgrades to the existing models, with funds provided by the proponent. The long term correction to this shortfall is the development of the future gaming simulations (Joint Simulation, Warfighter Simulation 2000 and Combined Arms Tactical Trainer). These simulations have a requirement for a very diverse synthetic environment, an absolute must in order to replicate the NBC hazards and smoke conditions of the future battlefield. With the establishment of proper conditions, commanders and staffs can truly comprehend the management problems associated with conducting war in a NBC and smoke environment.

There is currently no standardized instrumentation system (IS) that can realistically portray all facets of Nuclear, Biological and Chemical training to train the total force. The U.S. Army Chemical School is developing NBC Recon training devices for the detection and tracking of simulated NBC contamination at Maneuver Combat Training Centers (CTCs) and home station training areas. Proposed training IS will retrieve, process and calculate digital contamination data for maneuver units, and will also include AAR feedback in the areas of NBC casualties, change of custody, and reaction procedures during NBC attacks and operations. This IS would provide a realistic replication of NBC contamination as portrayed on the Battlefield. Resourcing will be pursued to field proposed training devices at CTCs and other locations.

5.6.2 Joint NBC Training/Joint and Combined Exercises

In an effort to improve and add realism to NBC training, the Joint Staff in Joint Pub 3-11, *Joint NBC Defense Doctrine*, formalizes the doctrine for Joint NBC training and exercises. During PF 98 (Mobilization) and PF 99 (Deployment), Atlantic Command (ACOM), in its role as the force provider, ensures that deploying units and personnel are certified as combat ready. The 1996 NIEX tested our nation's ability to respond to a crisis involving biological weapons.

Chairman of the Joint Chiefs of Staff (CJCS) Exercise Program

Joint NBC defense training objectives have been incorporated into the CJCS Exercise Program. This program includes three different types of exercises

(1) **Positive Force** (PF) exercises are large scale Command Post Exercises that normally consider national level issues such as mobilization and deployment. During PF 98 (Mobilization) and PF 99 (Deployment), Atlantic Command (ACOM), in its role as the force provider, ensures that deploying units and personnel are certified as combat ready. An integral part of this certification procedure is determining unit, personnel, and equipment operational readiness under NBC conditions.

(2) **Positive Response** (PR) exercises normally consider strategic nuclear level issues. In addition to considering command and control of nuclear forces, these exercises deploy, and backup national command and control personnel and systems annually. Capabilities of these redundant systems are equally applicable during chemical and biological scenarios as they are during nuclear scenarios.

(3) The **No-Notice Interoperability Exercise** (NIEX) program continues to focus on our ability to interdict the proliferation of nuclear, chemical, and biological weapons. In 1995, the NIEX required the interagency process to respond to a foreign nation's request to interdict and recover three stolen nuclear weapons. National level forces were deployed in response to this crisis. The 1996 NIEX tested our nation's ability to respond to a crisis involving biological weapons.

Army

The Army emphasizes integration of NBC defense training in unit rotations at the Combat Training Centers (CTCs). These centers include the National Training Center (NTC), Joint Readiness Training Center (JRTC), the Combat Maneuver Training Center (CMTC), and the Battle Command Training Program (BCTP).

The Army continues to see positive results in training based on external evaluation of unit Army Training and Evaluation Programs (ARTEPs) conducted at the NTC, JRTC, and other training locations world-wide. These results clearly show and emphasize that through continued training, soldiers can increase their ability to perform combat missions despite degradation caused by wearing a protective ensemble. Units which (1) have the necessary command support and equipment, (2) balance NBC within their overall training requirements, and (3) execute according to approved training plans, perform their overall mission better in a simulated NBC environment. However, increasingly constrained training resources limit training to fundamentals; often this means training for operating in an NBC environment is not funded.

Air Force

NBC warfare defense preparedness is an integral part of periodic Operational Readiness Inspections conducted by Major Command Inspectors General. Realism is injected into these scenarios using a simulated wartime environment including the use of bomb simulators, smoke

and attacking aircraft. Personnel are tasked to perform war skills while in their full complement of protective equipment. Additionally, Air Force units participate in major joint and combined exercises which incorporate realistic NBC situations. Following are examples from the Pacific Air Force (PACAF) which describe exercises incorporating NBC situations:

- TEAM SPIRIT - Joint/combined large scale air, sea, land exercise to demonstrate US resolve in South Korea.
- ULCHI FOCUS LENS - Joint/combined command and control exercise conducted in conjunction with the Republic of Korea's national mobilization exercise "ULCHI."
- FOAL EAGLE - Joint/combined rear area battle and special operations field training exercise.

Navy

Due to the unique nature of Naval vessels, CBR defense training is conducted similarly whether platforms are operating independently or in a group. Even in a battle group scenario, the task force would still continue with the mission while each unit would conduct NBC defense against certain attacks. Therefore, formal training is conducted by Afloat Training Groups while platforms are operating independently. Required training exercises are conducted by each unit every three months in order to maintain their readiness rating. During scheduled NBC defense training periods, realism is stressed. NBC defense equipment is used extensively. Protective masks and suits are worn by required personnel.

Inter-Deployment Training Cycle (IDTC) are notional cycles which have at lest four full scale CBR-D exercises conducted prior to the predeployment readiness evaluation. Exercises incorporate all personnel and demonstrate all CBR-D equipment. Also, readiness standards require that at least two full-scale graded CBR-D exercises be conducted every six months.

Marine Corps

The Marine Corps incorporates NBC training into combined arms exercises at the Marine Corps Air Ground Combat Center in Twenty Nine Palms, California. Battalion level unit exercises are also conducted during Korea and Thailand Incremental Training Programs where units deploy and exercise various tasks. Like the Air Force and Army, the Marine Corps also participated in major joint/combined exercises. The level is determined by mission, threat, and task organization. During FY96, the Marine Corps incorporated NBC defense training into such exercises as JTF Exercise UNITED ENDEAVOR, ULCHI FOCUS LENS96, FOAL EAGLE and IMEFEX 96. It should be noted that all Marine Corps units must also conduct quarterly NBC exercises. Evaluations include operational, administrative, and logistical functional areas. These exercises incorporate realistic NBC defense training into the exercise scenario to enhance the value of the exercise

5.7 INITIATIVES

5.7.1 Joint

Doctrine

Initiatives in Joint NBC defense doctrine are detailed in section 5.2.

Modeling

The Deputy Assistant Secretary of Defense for Chemical and Biological Matters, DATSD(CBM), and the Deputy Under Secretary of the Army for Operations Research (DUSA-OR) have initiated a CB Modeling Process Action Team whose purpose is to "provide OSD with a consolidated and integrated CB modeling program, where possible, harmonizing individual Service and Agency work into joint programs and eliminating duplication and overlapping projects." We initiated a system to establish configuration control and a model repository and data base through the CB Information Analysis Center. Our goal is to allow all aspects of CB defense to be performed in the Distributive Interactive Simulation (DIS) arena.

In response to a Joint Requirement Oversight Council (JROC) question concerning the impact of weapons of mass destruction (WMD) on medical force structure, the Joint Staff is currently conducting a "Joint WMD Analysis" using the models TACWAR and METRIC to evaluate the effects of chemical and biological agents on theater level warfighters. Among the many issues related to use of WMD, potential casualties of WMD will be used to review medical force structures.

Training

5.7.2 Army

In an effort to refine doctrine and training, the Army is quantifying the impact of NBC environments on combat operations. Two programs have been executed to achieve this goal: (1) Combined Arms in a Nuclear/Chemical Environment (CANE), and (2) Physiological and Psychological Effects of the NBC Environment and Sustained Operations on Systems in Combat (P^2NBC^2). These Force Development Testing and Experimentation (FDTE) evaluations have improved our understanding of individual and unit operations and performance degradation while in Mission Oriented Protective Posture (MOPP). The CANE FDTE evaluations quantified field data that commanders can use for planning, training and decision making to respond to the threat.

The Army, as proponent for CANE tests, has completed five field evaluations (mechanized infantry squad/platoon in 1983, tank company team in 1985, armor heavy battalion task force in 1988, light infantry forces in 1992, and air defense artillery in 1993). The Army has established the CANE Implementation Plan (CIP), a systematic review process to ensure identified deficiencies are addressed and corrected. The Commander of the Army's Training and

Doctrine Command (TRADOC), reviews the CIP annually. Army field manuals are then revised to address deficiencies identified in CANE tests.

Before CANE FDTEs were conducted, commanders' training in a simulated NBC environment had an indication of the degradation that MOPP places on their operations. They were aware that training could maximize proficiency, but they lacked the feedback to direct that training. Consequently, training was often sporadic and incomplete.

The Army is now implementing several training guidance improvements by:

- Providing heightened command emphasis to unit commanders on NBC threat with attention to Third World countries;
- Simulating NBC environments in training;
- Continuing emphasis and effort to integrate safe, realistic NBC defense in all training;
- Extending wear of MOPP gear in basic and annual training.

5.7.3 Air Force

The Air Force currently has three training and readiness initiatives underway and continues to improve its professional training.

The Civil Engineer Readiness Technical School implemented an advanced course at the CDTF. The training is scenario driven, versus lockstep, and revolves around a terrorism incident involving chemical munitions. Air Force instructors are qualified to conduct joint classes at the CDTE and are fully integrated into CDTF operations. Readiness personnel lead every Air Force class through the training and also assist the other services with their training requirements.

The school is in the process of revising its courses of instruction in order to meet the requirements of the Specialty Training Standard (STS) approved in October 1996. The new STS requires Readiness personnel be much more qualified in biological warfare operations, to include the use of emerging detection and plotting technologies.

Air Force Readiness personnel in the field who are enrolled in correspondence courses for upgrade training to the five skill level will have the opportunity to elect to receive the course on fully interactive CD-ROM with full motion-video and sound. The course is presently available only in a paperback version, which will continue to remain available after the CD-ROM release. Interactive courseware will begin development in fiscal year 1997.

5.7.4 Navy

The Navy's main initiative is integration of CBR-D requirements in the tactical training strategy. These requirements are executed via the interdeployment training cycle's aggressive training and material readiness program. Additionally, the funds made available from the FY96 National Defense Authorization bill are being utilized to upgrade existing training aids and

delivery of training support ADP equipment to all units. Navy is also investigating required preparations and training associated with large area decontamination. The Naval Facilities Engineering Command is currently conducting a study in this area with the results expected in 2QFY97.

Additionally, the Navy's basic NBC defense course has been incorporated in both officer and enlisted accession training curriculums. In conjunction with this initiative, the same course taught at the fleet training centers has been restructured to improve throughput.

5.7.5 Marine Corps

During FY96, the Marine Corps training initiatives centered on the establishment of a Chemical and Biological Incident Response Force (CBIRF) to counter the growing biological and chemical terrorist threat. The CBIRF was activated April 1, 1996 and was deployed to the Olympics in Atlanta during the summer.

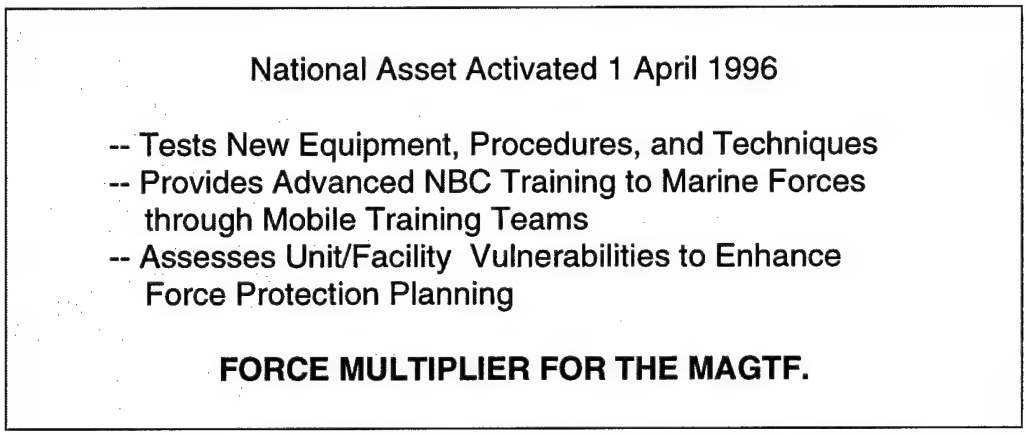

Figure 5-5. Chemical/Biological Incident Response Force (CBIRF) Role in Training

The CBIRF focuses on consequence management to terrorist-initiated NBC incidents. The CBIRF is a national asset, to be globally sourced to Marine Force Commanders and National Command Authority for duties as the President may direct. The CBIRF consists of 380 skilled and trained personnel, including civilian experts. The organization consists of six sections: Command (including a Reach-Back Advisory Group), Security, Service Support, NBC Reconnaissance, Decontamination, and Medical. The CBIRF is equipped with state-of-the-art detection, monitoring, and decontamination equipment and is prepared for operations in a wide range of military-civilian contingencies. The Commanding General, Marine Corps Combat Development Command will continue to develop concepts, doctrine, and tactics, techniques and procedures for this CBIRF. In addition to the CBIRF's capabilities to respond to chem/bio incidents it serves as a training asset to the operational forces. The CBIRF will provide mobile training teams to various units to provide advanced NBC training to unit NBC specialists (train-the-trainer). This will provide operational forces with the most up-to-date NBC techniques, tactics, and procedures developed by the CBIRF. CBIRF will also conduct Unit/Facilities Vulnerability Assessments to enhance force protection. The bottom line is that the CBIRF will serve as a force multiplier to the MAGTF.

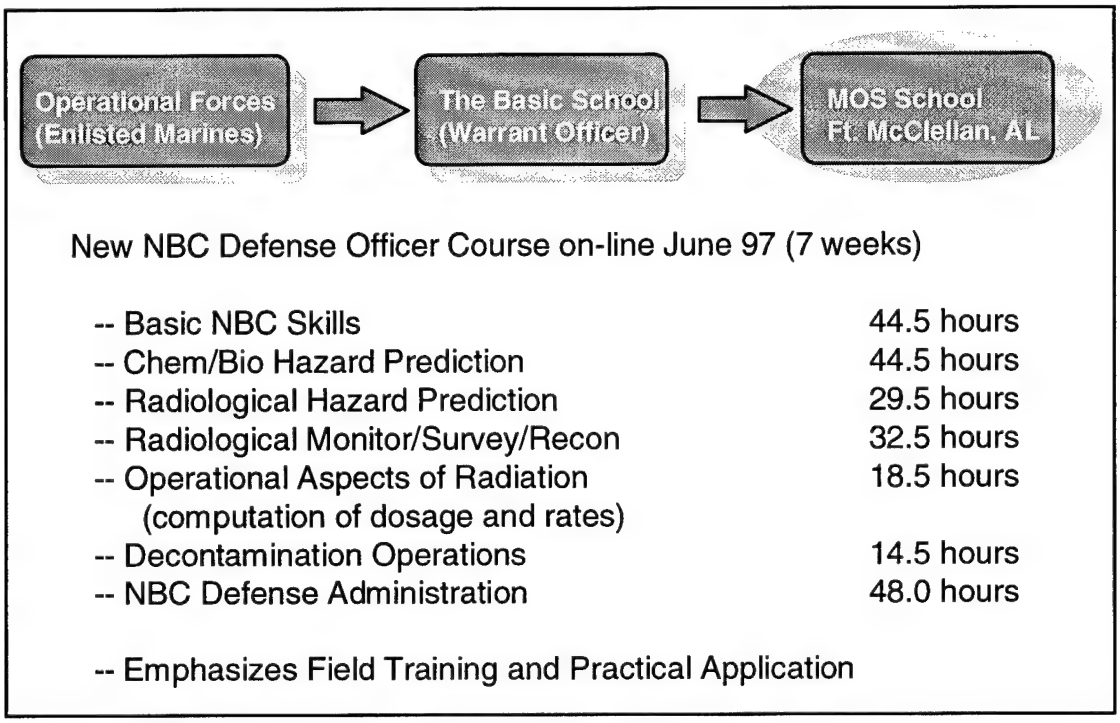

Figure 5-6. USMC Individual Training (NBC Officer Training)

NBC OFFICER TRAINING. Establishment of a Marine Corps Basic NBC Officer Course is complete. This course provides the requisite NBC skills to newly selected Marine Corps NBC Defense Officers. The first course will begin in June 1997. All Marine NBC Officers are Warrant Officers, usually selected from NBC Defense specialist enlisted ranks. As Warrant Officers, they focus entirely on technical expertise, NBC Defense training, and supervision of enlisted NBC Defense specialists. In the past, Warrant Officers relied on the training they had received as enlisted NBC Defense Specialists and on-the-job training. However, the new NBC Defense Officers Course will be geared specifically towards Warrant Officers and will build on previous training received.

NBC Officers also attend the Army's Chemical Officer Advanced Course and Joint NBC courses as part of advanced Military Occupational Specialist (MOS) training.

Marine Corps initiatives for FY97 will include:

- Integration of NBC defense procedures in Mission Oriented Tasks (Garrison and Field).
- Review MCO 1510.71, Marine Corps NBC Specialist Individual Training Standards (ITS).
- Conduct NBC Defense Course Content Reviews based on revise ITS's and emerging NBC equipment requirements.
- Conduct Table of Equipment and Table of Organization Reviews.
- Complete implementation of an NBC Staff Planning follow-on course, a training course to prepare NBC defense officers and NCOs to assist in the staff planning process.

- Establishment of combat training package for ISMs for reserve forces and follow-on forces in the event of hostilities involving an NBC threat.
- Conduct 2d Annual Joint Marine Corps and Navy shipboard decontamination exercises with 7th Fleet.
- Continue participation in a bilateral exchange program with the Republic of Korea (ROK) Chemical Corps.

5.8 READINESS REPORTING SYSTEM

CJCS MOP 11, the policy document for the Status of Resources and Training System (SORTS) requires units from all Services to independently assess their equipment on hand and training status for operations in a chemical and biological environment. This is a change to previous SORTS reporting requirements, and provides more visibility to NBC defense related issues.

The Services individually monitor their SORTS data to determine the type of equipment and training needing attention. Units routinely report their equipment on hand and training status for operations in a chemical or biological environment. Commanders combine this information with other factors, including wartime mission, to provide an overall assessment of a unit's readiness to go to war.

Additionally, the Commanders-in-Chief (CINCs) of the Unified Commands submit readiness assessments at each Joint Monthly Readiness Review (JMRR). In the JMRR, CINCs assess the readiness and capabilities of their command to integrate and synchronize forces in executing assigned missions. As needed, CINCs address NBC defense readiness and deficiencies as part of the JMRR.

5.9 NBC DEFENSE TRAINING AND READINESS ASSESSMENT

➢ **DoD lacks a mechanism to provide adequate information on the current status of training, equipment, and readiness. It needs adequate information to assess operational force capabilities from the Department and the warfighting CINCs' perspectives.**

***SOLUTION*:** Assign consistent and higher priority to NBC defense, especially by the Joint Chiefs of Staff and the warfighting CINCs, in order to maintain an adequate state of readiness and to ensure NBC defense reporting information is accomplished in a timely and adequate manner. Existing reporting systems may provide an adequate mechanism for assessing readiness.

➢ **Joint NBC defense doctrine needs to be continually developed and include joint tactics, techniques, and procedures.**

***SOLUTION*:** Initiatives began in 1987 to develop joint NBC defense doctrine which resulted in Joint Pub 3-11, *Joint Doctrine for Nuclear, Biological, and Chemical (NBC) Defense*. In FY95 efforts were initiated to update this document. The Joint Service Integration Group, assisted by the U.S. Army Chemical School Joint Doctrine Cell, is responsible for assisting the U.S. Army in the development of this doctrine under sponsorship of the Joint Staff. Continued Service interaction and cooperation facilitated by these organizations will produce the next generation of Joint NBC Defense Doctrine.

➢ **There are limited chemical and biological features in wargaming and planning models.**

SOLUTION: Funding to add chemical and biological warfare to exercise scenarios has been received for FY96. Efforts are underway in the current DoD programming cycle to establish long term support. The CB Modeling Process Action Team is also addressing this issue.

CHAPTER 6

PREPARATIONS FOR THE CHEMICAL WEAPONS CONVENTION

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6.0 INTRODUCTION

The Chemical Weapons Convention (CWC) was opened for signature on January 13, 1993. As of January 1, 1997, 164 countries have signed the CWC. On October 31, 1996, Hungary became the 65th country to ratify the treaty, thus initiating proceedings for entry into force. Entry into force (EIF) is scheduled to take effect on April 29, 1997—180 days after the 65th ratification. As of March 1, 1997, 70 countries have ratified the treaty, not including the United States. The U.S. Senate is scheduled to hold hearings on the CWC during early 1997. The Senate may hold a vote on whether to provide its advice and consent on the treaty prior to EIF, though no date for the vote has been set as of March 1, 1997.

6.1 DEPARTMENT OF DEFENSE PREPARATION

The Department of Defense conducts an Implementation Working Group (IWG) to plan for implementation of the Chemical Weapons Convention (CWC) and related bilateral chemical weapons agreements. Through regularly recurring meetings, representatives of the Office of the Secretary of Defense (OSD), the Joint Staff, the Military Services, and DoD agencies and activities coordinate planning efforts to ensure successful implementation of the CWC and related CW agreements. Formal meetings of the CWCIWG are scheduled approximately monthly and *ad hoc* meetings are held as needed to address short-notice requirements. Upon implementation of the CWC a counterpart Compliance Review Group (CRG) will be established within DoD. The CWCCRG will meet as needed to address ongoing compliance concerns.

The Military Services and the On-Site Inspection Agency (OSIA) have developed individual implementation plans to provide guidance for their commands and activities under the CWC and the related agreements. As outlined in their plans, the Services and OSIA have conducted assistance visits and formal exercises to ensure that all elements are prepared to comply with the agreements.

The Military Services have individually established implementation support offices which participate actively at the DoD CWCIWG, provide Service policy direction, and conduct ongoing liaison with their major commands to ensure that all military elements are fully prepared for inspections under the CWC and related CW agreements.

In accordance with the DoD Program Plan for Research, Development, Test and Evaluation (RDT&E) for Arms Control, the Defense Special Weapons Agency (DSWA) directs the DoD RDT&E effort to ensure that arms control verification proceeds using the most effective technology available.

OSD, the Joint Staff, the Military Services, OSIA and DSWA frequently provide technical experts to support activity at the CWC Preparatory Commission (PrepCom) in The Hague, The Netherlands. The PrepCom is charged with developing procedures and implementing the international forum, the Organization for the Prohibition of CW (OPCW), which will oversee worldwide compliance with the CWC.

OSD and the Joint Staff have provided representation and OSIA has provided operational advice to US negotiating delegations in Moscow, Russia for completion of CW bilateral implementation protocols. Discussions continue concerning follow-on aspects of the historic Wyoming MOU, for which inspections were completed in December 1994. Negotiation of protocols to enable implementation of the Bilateral Destruction Agreement (BDA), which was signed in 1990, continues.

6.2 TRAINING FOR INSPECTORS

DoD has been involved in several efforts to train individuals to perform duties related to various CW agreements. The OSIA has a training program for both OSIA cadre and augmentees from Defense and other governmental agencies. This three phased program includes one week of classroom instruction in the Washington area, one week of hands-on practical exercises (including operation in a toxic-agent environment) at the US Army Chemical School, Fort McClellan, Alabama, and specialized team training at various locations.

In an effort to ensure that inspectors working under the auspices of the CWC and the OPCW are adequately trained to perform their duties, DoD requested DSWA to develop a training program that might be offered to the OPCW as a method of training inspectors. DSWA contracted with the U.S. Army Chemical School to develop a suitable training program for OPCW inspectors. Using the Chemical School's preliminary draft program as a model, the Preparatory Commission of the OPCW developed a General Training Scheme for CWC inspectors. The United States has formally offered to participate in this program and will teach several courses at various U.S. facilities. (A *Module 1 Basic Course* will not be taught in the United States as originally proposed.) Several *Module 2 Specialty Training Courses* have been offered to include: (1) a three week Demilitarization of Chemical Weapons Course to be taught at the Chemical Demilitarization Training Facility, Edgewood Area, Aberdeen Proving Ground, Maryland; a two week Inactivation, Conversion, and Destruction of Chemical Weapons Production Facility Course to be taught at Pine Bluff Arsenal, Arkansas; and a two week Conventional and Chemical Munitions Course to be taught at the U.S. Army Chemical School. (On February 7, 1997 the Provisional Technical Secretariat (PTS) of the OPCW decided not to conduct any module 2 training in the United States citing the still unresolvable "technical transfer" issue. This is the same issue that resulted in the cancellation of module 1 training.) The U.S. has also offered to provide facilities for *Module 3 Inspection Team Training*. Anniston Army Depot will provide the training site for Chemical Weapons Storage Site inspection team training. Pine Bluff Arsenal will provide the site for CW Production Facility team training. The Chemical Agent Munitions Disposal System at Tooele Army Depot will provide the training site for destruction site inspection training. (As of March 1, 1997, the issue of conducting the module 3 training in the United States has not been resolved.) Additionally, the United States has offered to jointly participate with other countries to develop and present training courses. The US, United Kingdom, and Finland will jointly conduct a Sampling and Analysis Course in Helsinki, Finland and Porton Down, UK. The United States and Germany will jointly conduct a Non-destructive Evaluation Course to be taught in Münster, Germany. The Provisional Technical Secretariat of the OPCW has also formally requested U.S. assistance in teaching the Team Communication and Management Course that will be taught in The Hague,

The Netherlands. The United States will no longer assist in teaching any courses for the PTS, but has elected instead to provide santized versions of the programs of instructions to the PTS.

6.3 PREPARATION OF DEFENSE INSTALLATIONS

OSIA has coordinated actively with the Military Services in preparing DoD installations for inspections under the CWC and related bilateral CW agreements. All Defense installations which will be subject to declaration under the requirements of the CWC, and many which will be subject to challenge even though not declared, have been visited by OSIA technical experts and Military Service representatives. A series of staff assistance visits, joint training exercises, and mock inspections have been carried out at installations identified by the Military Services as being potentially vulnerable. Furthermore, the Military Services have initiated efforts to ensure that affected commands take timely and appropriate measures to reduce vulnerability.

OSIA has expended nearly 6,300 man days conducting site visits, field training exercises, bilateral CW agreement inspections, and other on-site activities (over 158 separate events) in preparation for the CWC and related CW agreements. OSIA has visited, on a recurring basis, every DoD CW-related facility in the US that will be declared under the CWC. In addition to assistance visits and routine training exercises, a total of 64 mock inspections and five inspections under a bilateral CW agreement have been conducted at US facilities over the past three years. Activity is continuing to ensure that all US DoD facilities are in full compliance with the applicable CW mandates.

6.4 PREPARATION OF DoD-CONTRACT INSTALLATIONS

In the event of CWC inspection of DoD-contract activities, the Defense Treaty Inspection Readiness Program (DTIRP), for which OSIA is the DoD Executive Agent, has a trained cadre of technical experts from the security countermeasures and counterintelligence community to assist defense contractors in preparing for a CWC challenge inspection. The DTIRP personnel have conducted CW vulnerability assessments and site assistance visits, and have participated in numerous mock inspections and table top exercises. In order to assist program and facility managers, OSIA has developed a sophisticated arms control risk assessment model designed to address risks to national security and proprietary information. The DTIRP system enables the assessment of susceptibility, as well as vulnerability, and the level of preparation needed to protect critical technologies, sensitive programs, and capabilities.

OSIA has implemented an extensive outreach program to provide information about the CWC, security countermeasures, facility preparation, and DTIRP to both government and DoD industry. OSIA provides training and awareness services through such fora as industry seminars, mobile training teams, mock inspections, tabletop exercises, industry associations, national conventions and symposia. DTIRP speakers participated in more than 50 outreach events during the last fiscal year. OSIA also publishes various educational products (printed and video) and administers electronic bulletin boards to provide information concerning the CWC to government and industry.

Through DTIRP, OSIA maintains an operational capability to deploy counterintelligence personnel and specialized equipment to support assistance teams at challenged facilities on short notice. DTIRP is an integral support element to the Military Services, Department of Energy, and others for CW challenge inspections at their undeclared, as well as their declared, facilities. This capability will be available to support DoD and government contractors during implementation of the CWC.

6.5 COOPERATIVE THREAT REDUCTION (CTR): RUSSIAN CHEMICAL WEAPONS (CW) DESTRUCTION SUPPORT PROGRAM

The Cooperative Threat Reduction (CTR) Program, a bi-partisan Congressional initiative created in November 1991, is an effort to enhance the national security of the United States through cooperative engagements with Russia, Belarus, Kazakhstan, and Ukraine aimed at diminishing the threat posed by weapons of mass destruction along with their associated delivery systems. Establishment of the CTR Program was a direct response to the political and economic uncertainties associated with the disintegration of the former Soviet Union that called into question the ability of the newly independent states to provide for the safe and secure transportation, storage, and eventual reduction of complete elimination of these weapons. With respect to chemical weapons, the objective of the CTR Program is to assist the Russian Federation in the safe, secure, timely, cost-effective and environmentally sound destruction of its CW stockpile, specifically nerve agent destruction, and thus to contribute to Russia's ability to meet the destruction milestones of the Chemical Weapons Convention.

This program is currently focused on two primary projects: (1) development of a Chemical Agent Analytical Monitoring capability, and (2) establishment of a Chemical Weapons Destruction Facility (CWDF). An Implementing Arrangement between DoD and the RF Ministry of Defense to facilitate coordination of the CWDF-related project was concluded on July 10, 1996.

The Chemical Agent Analytical Monitoring project is assisting the RF in establishing a multi-laboratory system to provide chemical agent and environmental monitoring capabilities to support the Russian CW destruction program. This project currently consists of two primary components: establishment of a Central CW Destruction Analytical Laboratory (CAL) at the Moscow Research Institute of Organic Chemistry and Technology (GosNIIOKhT), and the provision of three mobile laboratories. The three mobile labs were procured under an existing U.S. Army contract and delivered to Russia in September 1996. A contract to support establishment of the CAL was awarded to ConTrack International, Inc. in October 1996.

The CWDF project is the keystone of the program and will likely be the major CTR activity in Russia in the final years of the CTR program, *i.e.*, FY 2000 and beyond. It consists of several tasks that are directed towards achieving an operational CW destruction facility at Shchuch'ye, Kurgan Oblast. These tasks include the following:

- Preparation of site-specific planning documentation to include project cost estimates and schedule, process and facility design baseline data, a site feasibility study (Justification of

Investment), and an initial environmental impact assessment. The effort is being conducted under a contract awarded to Bechtel National Incorporated (BNI) in May 1994.

- Optimization of the Russian two-step (neutralization/bituminization) chemical destruction process, previously evaluated in both U.S. and Russian laboratories and found to achieve satisfactory agent destruction levels, will entail additional laboratory scale tests necessary to design a bench scale reactor system for further testing and development of the destruction process equipment for a CWDF. This work is being done under a contract awarded to Battelle Memorial Institute in September 1996.

- Process scale-up and equipment development to include bench scale testing of the destruction processes, munitions processing machinery development and testing, and related technical and engineering studies. An Engineering Management Support (EMS) Contract was awarded to The Ralph M. Parsons Company of Delaware on December 3, 1996 to perform this work.

- Process and facility design will be conducted based on the results of the other ongoing tasks to support the decision-making process leading to approval to begin construction of the Shchuch'ye CWDF. This work will be performed under the EMS contract.

- Actual construction and start-up of the CWDF will include facility construction, equipment acquisition and installation, operator training and systemization of the CWDF, which may be executed as options to the EMS contract. It should be emphasized that implementation of this work will require annual authorization and appropriations from the U.S. Congress.

The implementation of a third CW related CTR project, Chemical Weapons Production Facility Dismantlement, is pending an Implementing Agreement to support dismantlement, conversion and/or redirection of former Soviet CW production capability at the Volgograd "KHIMPROM" Complex or other former production facility.

6.6 VERIFICATION TECHNOLOGY

In January 1991, DoD modified DSWA's charter to add the conduct of Research, Development, Test, and Evaluation (RDT&E) for inspection technology related to arms control treaty verification. Today, the DSWA Chemical Biological (CB) Arms Control Technology (ACT) Office has the lead within DoD for developing the technologies for implementation of CB arms control treaties and agreements. This function is integral to the global arms control component of the U.S. National Security Strategy.

The CB ACT Office conducts RDT&E to support U.S. roles in global CB arms control initiatives by developing technologies and procedures for DoD identified implementation, verification, monitoring, and inspection needs as required by CB arms control agreements. The CB ACT program is directed towards protecting national security interests, improving the

effectiveness of verification efforts, assisting the United States to meet legal obligations imposed by treaty provisions, supporting development of U.S. policy, minimizing inspection and implementation costs, and enhancing the safety of treaty inspections. DSWA's designation as a combat support agency will add another important focus, whereby the CB ACT program will also consider the impact of CB arms control agreements on warfighting commanders and their missions.

The current DSWA CB ACT Program focuses on the following:

- support to negotiations,
- compliance support/data management,
- inspector safety monitoring,
- off-site monitoring,
- non-destructive evaluation,
- on-site analysis.

Support to Negotiations

The CB ACT Office provides technical support to the Office of the Secretary of Defense (OSD) in the form of technical experts and information related to CW compliance and implementation support. The program also provides for support to OSD and OSIA for bilateral arms control negotiations with the Russian Federation (RF).

Through the CB ACT program, DSWA provides technical support to U.S. negotiators involved with Biological Weapons Convention (BWC) Review Conferences and to OSD staff engaged in exchange visits to military biological facilities under the auspices of the US/UK/RF Trilateral Statement.

Compliance Support/Data Management

The CB ACT program supports the development of DoD data and notification management systems that satisfy U.S. treaty reporting requirements. The CWC Information Management System (CWCIMS) was developed for, and adopted by the Organization for the Prohibition of Chemical Weapons (OPCW) to assist in scheduling and managing CWC inspections. The Chemical Agent Management Information Network (CAMIN) is a joint DSWA/Army program which provides a means to address DoD data declarations required by the CWC. The CB ACT Program Office is also developing a proposed data management system to assist with the submission of annual declarations under the BWC.

Inspector Safety Monitoring

Ensuring inspector safety during arms control inspections is a priority concern. The CB ACT Program Office continues to pursue a real-time portable CW agent monitor for the detection of trace levels of volatile CWC scheduled chemical to assure that inspectors are not exposed to a hazardous area. The key challenges on this effort involve meeting time weighted

average (TWA) detection limits, satisfying intrinsic safety requirements for the instrument, and meeting false negative and false positive accuracy criteria.

Off-Site Monitoring

The CWC permits monitoring during challenge inspections at a negotiated perimeter. The CB ACT program continues to focus on evaluation of technologies that can be used to monitor the perimeter of facilities undergoing challenge inspections. (See for example *Sample Screening* below.)

Non-Destructive Evaluation (NDE)

NDE systems permit the non-invasive interrogation of munitions and containers. The current CB ACT program is exploring the following technologies:

- Acoustic Resonance Spectroscopy (ARS) - a mature technology used to classify munitions by content. It requires the development of a matching template database.

- Portable Isotopic Neutron Spectroscopy (PINS) - PINS employs neutron radiation from a small radioisotopic source. Chemical elements are identified by their characteristic gamma ray signature. PINS is now available commercially and has been used successfully by the U.S. Army to identify the contents of hundreds of munitions recovered from burial sites and firing ranges.

- Swept Frequency Acoustic Interferometry (SFAI) - SFAI can identify liquid agent inside munitions and containers by measuring several of its physical properties, such as density, and the attenuation of sound speed over a wide range of frequencies. In contrast to ARS, SFAI does not require a template signature.

The continuing challenge for NDE is to meet speed, accuracy, logistics, safety, and human engineering criteria. The focus is on developing a single, multi-function instrument which is intrinsically safe, provides fast analysis, meets a high level of identification confidence, and which can be operated in full protective clothing.

On-Site Analysis

On-site analysis represents the broadest and most intense effort in the CB ACT program. To be successfully performed, it requires state-of-the-art sample collection, screening, preparation and determinative analysis methods and equipment.

The United States has taken the lead in the development of an on-site laboratory. DSWA prototypes, such as the "fly-away lab," which has been used to support UN Special Commission inspections in Iraq, and the "Modular Laboratory" which has been adapted for use in the U.S. CWC compliance program are examples of on-site laboratory proof-of-concept efforts. DSWA continues to guide its on-site analysis program towards a laboratory employing

field portable equipment, instrumentation and techniques, which meet specific criteria designed to maximize sampling and analysis capabilities under the time and logistics constraints of a CWC inspection.

Sample Screening - CWC inspectors require a screening system that will be effective for all compounds of interest, including non-volatiles. The system must also minimize and preferably eliminate false negatives, be intrinsically safe to use, and contribute minimally to an already profound logistics burden.

Sample Preparation - The CB ACT Office has pursued sample preparation procedures which emphasize speed and minimize the complexity of extraction, derivitization, and concentration. A proposed sample preparation method for gas chromatography/mass spectrometry (GC/MS) has been developed through a joint U.S./Finnish partnership.

Determinative Sample Analysis - The CB ACT Office is pursuing technology improvements to satisfy determinative analysis requirements. The goals are to reduce power consumption, increase sample throughput, and ruggedize packaging, while reducing false positives to zero. DSWA also has addressed the requirement to prevent the loss of national security and confidential business information during inspections by initiating a project to develop "masking" or "blinding" software for analytical instruments. The software is designed to prevent inspectors from accessing data not relevant for an inspection. Thus far, this project has produced software for use with GC/MS, which DSWA has made available to industry. Similar requirements are now anticipated for data generated by all analytical instruments used on an inspection site.

ANNEX A

CONTAMINATION AVOIDANCE PROGRAMS

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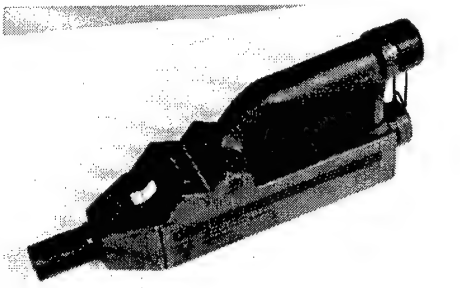
SECTION 1: PRODUCTION AND FIELDED ITEMS

Detectors and Monitors

Chemical Agent Monitor (CAM)

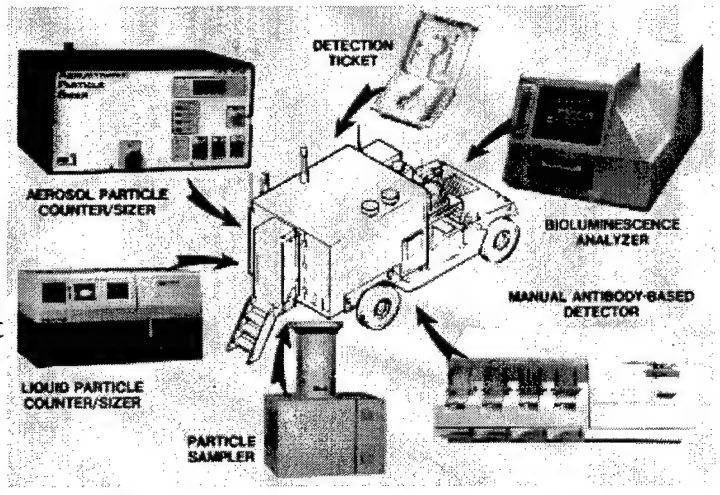


The CAM is a hand held instrument capable of detecting, identifying, and providing relative vapor concentration readouts for G and V type nerve agents and H type blister agents. The CAM uses ion mobility spectrometry (IMS) to detect and identify agents within 1 minute of agent exposure. A weak radioactive source ionizes air drawn into the system and the CAM then measures the speed of the ions' movement. Agent identification is based on characteristic ion mobility, and relative concentrations based on the number of ions detected. The three pound, 15" long CAM can be powered either by an internal battery, or by an external source through the CAM's combination power/fault diagnosis plug. The CAM may be used for a variety of missions, to include area reconnaissance and area surveillance, and monitoring of decontamination operations.

Improved Chemical Agent Monitor (ICAM) - Production

The improved CAM (ICAM) significantly reduces the level and frequency of maintenance without effecting the CAM's performance. The ICAM sieve pack has double the capacity of the two CAM sieve packs, which results in twice the operational life of the ICAM over the CAM.

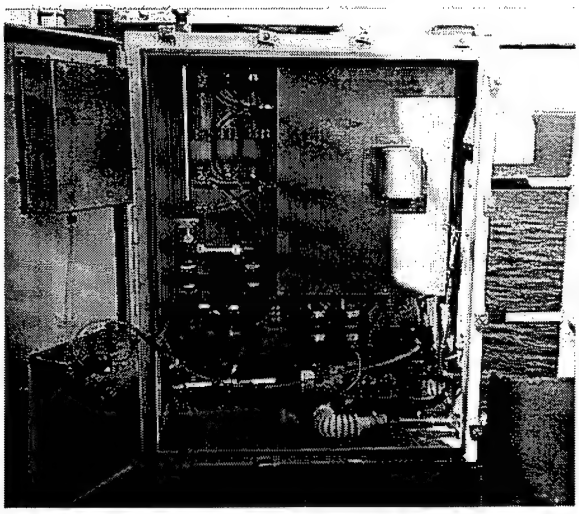
M31 Biological Integrated Detection System (BIDS) NDI



BIDS uses a multiple technology approach, both developmental and off-the-shelf materiel, to detect biological agents with maximum accuracy. BIDS is a vehicle-mounted, fully integrated biological detection system. The system, which is a collectively-protected, HMMWV-mounted S788 shelter, is modular to allow component replacement and exploitation of "leap ahead" technologies. Thirty-eight BIDS (NDI versions) have been fielded to the first ever biological detection company, the 310th Chemical Company (U.S. Reserve) during FY96. This gives the Department of Defense its first credible, rapidly deployable biological detection capability. The BIDS is a Corps level asset. The BIDS program includes a P^3I research and development effort which will integrate the CB Mass Spectrometer (CBMS) with the Biological Detector as sub-components. Each sub-

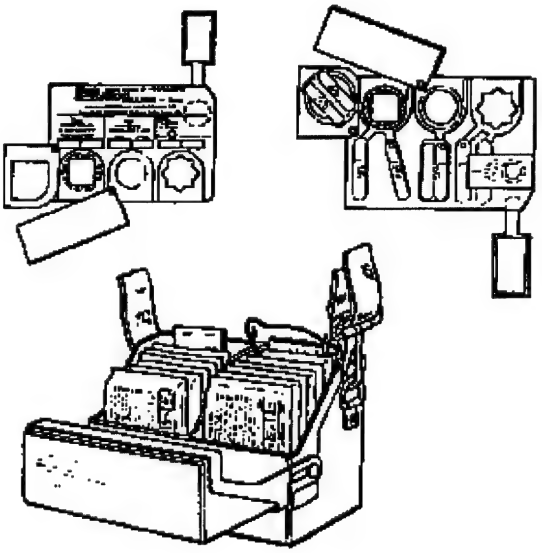
component may also be used as stand-alone systems to meet other service needs.

Interim Biological Agent Detector (IBAD) -Rapid Prototype



IBAD provides a near term solution to a deficiency in shipboard detection of biological warfare agents. IBAD consists of a particle sizer/counter, particle wet cyclone sampler and hand held immunochemical, colorimetric assay tickets for identification of suspect aerosol particles (flow through assay). The IBAD is capable of detecting a change in background, which may indicate a man-made biological attack is underway, and sampling the air for identification analysis. The IBAD can detect a change in background within 15 minutes, and can identify biological agents within an additional 30 minutes. It is a rapid prototype system that started service with the fleet in FY96. Fielding will continue through the first part of FY97. A total of 25 IBAD devices are being fielded. A design based on the basic IBAD system has been chosen as the sensor piece of the Airbase/Port Biological Detection Advanced Concept Technology Demonstration (ACTD).

M256A1 Chemical Agent Detector Kit

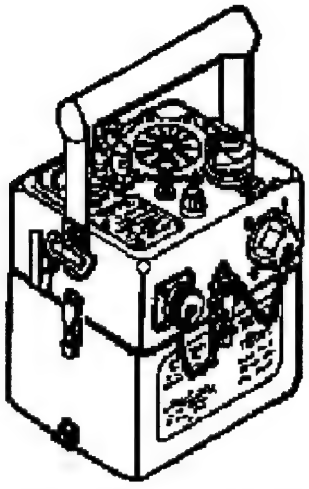


The M256A1 kit can detect and identify field concentrations of nerve agents (sarin, tabun, soman and VX), blister agents (mustard, phosgene oxime, and lewisite), and blood agents (hydrogen cyanide and cyanogen chloride) in about 15–20 minutes. The kit consists of a carrying case containing 12 individually wrapped detector tickets, a book of M8 chemical agent detector paper, and a set of instructions. Each detector ticket has pretreated test spots and glass ampoules containing chemical reagents. In use, the glass ampoules are crushed to release a reagent, which runs down pre-formed channels to the appropriate test spots. The presence or absence of chemical agents is indicated through specific color changes on the test spots. The kit may be used to determine when it is safe to unmask, to locate and identify chemical hazards (reconnaissance), and to monitor decontamination effectiveness.

ABC-M8 VGH, AND M9 Chemical Agent Detector Paper

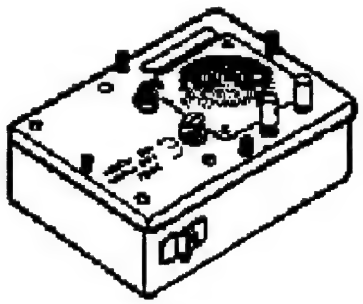
M8 and M9 paper are dye impregnated papers that change color when exposed to liquid chemical agent. These papers cannot detect chemical agents in vapor form. M8 paper comes in 4" by 2 $^{1}/_{2}$" booklets. Each booklet contains 25 sheets of detector paper that are capable of detecting G series nerve agents (sarin, tabun, soman), V type nerve agents, and H (mustard) type blister agents. M8 paper can identify agents through distinctive color changes from its original off-white: yellow-orange for G, blue-green for V, and red for H. M8 paper is typically used to identify unknown liquid droplets during chemical reconnaissance/surveillance missions. M9 paper is issued as a 33 foot long, adhesive backed strip that is rolled into a 3" 2 1/3" roll. M9 paper can detect G and V nerve agents, and H and L (lewisite) blister agents. It cannot distinguish the identity of agents. It turns red, red-purple, or red-brown when in contact with liquid chemical nerve and blister agents. M9 paper is typically placed on the BDO, equipment, and vehicle exteriors to warn personnel of the presence of a liquid chemical agent.

M8A1 Automatic Chemical Agent Alarm (ACAA)



M43A1 Detector Unit

The M8A1 ACAA is a system that continuously samples the air to detect the presence of dangerous concentrations of G and V type nerve agent vapors. The M8A1 ACAA may be employed in a number of configurations, but all configurations are built around the M43A1 detector unit, and the M42 alarm unit. The configurations differ primarily in their mountings and power supplies: ground mounted and battery operated, or mounted on a vehicle and powered by the vehicle's electrical system. The M43A1 detector unit measures 6 1/2" x 5 1/2" x 11" with the battery used in ground mounted operations adding another 7 3/4" in height. The M43A1 detector unit uses a radio-isotope to ionize molecules in the air that is pumped through the system, and detects electrical current changes that occur in the presence of nerve agents. The M43A1 detector unit will alarm within about 1-2 minutes from exposure to agent. The M42 alarm unit is a remote visual and audible alarm that measures 7" x 4" x 2 1/3." The M42 alarm unit may be placed up to 400 meters from the M43A1 detector unit to give users warning of an approaching agent cloud.



M42 Alarm

M-90 Automatic Agent Detector (AMAD)

The AMAD is an automatic nerve and mustard (HD) agent detector which detects agent in vapor form. This system is currently in use by the Air Force. It transmits an alarm by radio to a central alarm unit.

Automatic Liquid Agent Alarm (ALAD)

The ALAD is a liquid agent detector which can detect droplets of GD, VX, HD, and L as well as thickened agents. It transmits its alarm by radio to a central alarm unit. Although the remote transmission is useful, the device only detects droplets of liquid agent. It must be used in conjunction with other point and/or stand-off vapor agent detectors to afford a complete detection capability.

Chemical Agent Point Detection System (CAPDS), MK21, MOD1

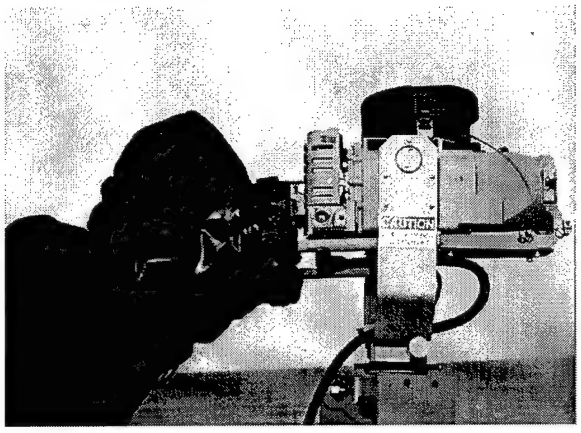
This is a fixed system capable of detecting nerve agents in vapor form, using a simple baffle tube ionization spectrometer. Installed in a ship's upper superstructure level, CAPDS obtains a sample of external air, ionizes airborne vapor molecules, and collects them on a charged plate after eliminating lighter molecules via the baffle structure. When a sufficient mass of ions is collected, a pre-set potential is achieved, and an alarm signal is generated and sent to both Damage Control Central and the bridge. The system has been installed on essentially all surface ships.

Improved (Chemical Agent) Point Detection System (IPDS) - Production

The IPDS is a new shipboard point detector and alarm that replaces the existing shipboard CAPDS. IPDS uses special elongated ion mobility cells to achieve the resolution necessary to counter false alarms caused by interferent vapors. IPDS can detect nerve and blister agents at low levels, and automatically provide an alarm to the ship. The unit is built to survive the harsh sea environment and the extreme electromagnetic effects of a Navy ship.

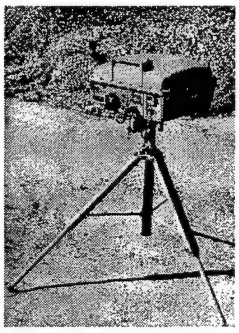
Stand-off Detection and Remote/Early Warning

AN/KAS-1 Chemical Warfare Directional Detector (CWDD)



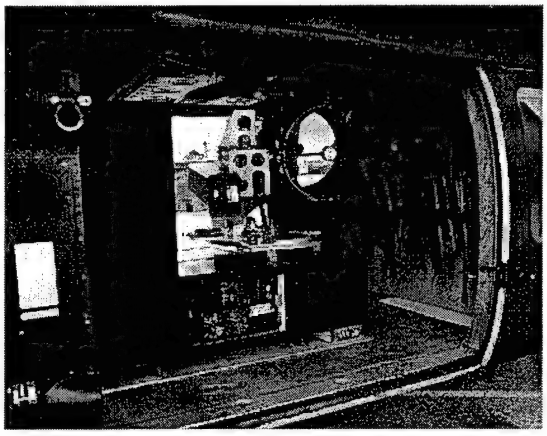
This is a semi-portable system designed to detect nerve agent vapor clouds at ranges up to 5 kilometers. The AN/KAS-1 must be removed from its stowage case and set up on a pre-installed pedestal for operation. Because the detector provides information for analysis of the infrared light emission characteristics of distant, manually acquired vapor clouds, it requires a trained, diligent operator to be effective. A new version of this system includes a remote video display providing enhanced capability for vapor cloud analysis, and a remote relative bearing indicator useful in guiding the ship to a man overboard or other surface target with a thermal signature.

M21 Remote Sensing Chemical Agent Alarm (RSCAAL)



The M21 RSCAAL is an automatic scanning, passive infrared sensor that detects nerve and blister agent vapor clouds based on changes on the infrared spectrum caused by the agent cloud. It is effective at line-of-sight distances of up to five kilometers. The alarm is used for surveillance and reconnaissance missions in both vehicle-mounted and tripod-mounted modes.

Long Range Biological Stand-off Detector System (LRBSDS) - NDI



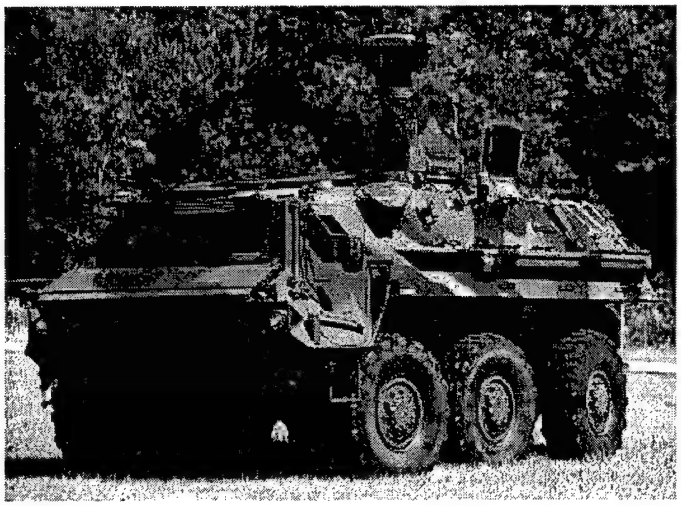
LRBSDS utilizes infrared light detection and ranging (IR-LIDAR) technology to detect, range and track aerosol clouds that are indicative of a BW attack; the LR-BSDS cannot discriminate biological from non-biological clouds. The system, which is approximately 800 pounds and three cubic meters, has three major components: a pulsed laser transmitter operating at infrared wavelengths; a receiver and telescope; and an information processor and display. This program, like the BIDS, has been designed in two phases; a NDI phase designed to rapidly field an interim capability, and a pre-planned product improvement (P3I) phase. The three NDI LR-BSDSs are already being fielded to their owning unit, the newly activated BIDS company (310th Chemical Company (USAR)). The NDI system is able to detect and track man-made aerosols out to 30 km, but is non-eyesafe out to about 5 km.

NBC Reconnaissance

XM93 NBC Reconnaissance System (NBCRS)

The XM93 is a dedicated system for NBC detection, warning, and sampling equipment integrated into a high speed, high mobility armored carrier capable of performing NBC reconnaissance on primary, secondary, or cross-country routes throughout the battlefield. The XM93 can find and mark chemical and nuclear contamination. Through a secure communications system, it provides warnings to follow-on forces. The crew is protected by an on-board overpressure system.

M93A1 NBC Reconnaissance System (NBCRS) - Production



The M93A1 is a system improvement phase (SIP) to upgrade the XM93 to detect chemical contamination vapors within 5 km using the M21 RSCAAL stand-off detector. It will automatically integrate contamination information from sensors with input from on-board navigation and meteorological systems. It rapidly transmits hazard warning via a central data processor and integrated digital jam-resistant communications. The M93A1 central data processing and manprint changes permit reducing the crew from four to three individuals. For the first time, this program also develops and fields organic supply and maintenance for the FOX NBCRS.

Radiacs

AN/VDR-2

The AN/VDR-2 measures gamma dose rates from 0.01 μGy/hr (micro-Grays per hour) to 100 μGy/hr and beta dose rates from 0.01 μGy/hr to 5 μGy/hr. The unit functions simultaneously as a dose rate meter and dose meter with independent adjustable alarms that can be set at any level over the entire range. Dosage data is independently stored in non-destructive memory for display on command and may be retained when the unit is turned off. The unit is powered by three 9 volt batteries.

AN/PDR-77 Radiac Set

The AN/PDR-77 Radiac Set is a set of portable radiation detection equipment for detecting alpha, beta/gamma, and x-ray radiation. The set consists of a radiacmeter to which one of three radiation probes can be attached for measuring particular types of radiation. The probes are part of the set. The set includes accessories and basic test and repair parts for unit maintenance including a carrying pouch with shoulder straps capable of holding the radiacmeter, alpha probe and beta/gamma probe for field use. The entire set is contained in a carrying case (large briefcase) for easy portability and storage.

AN/UDR-13 Pocket RADIAC (Platoon Radiac) - Production (FUE FY98)

The AN/UDR-13 Pocket RADIAC is a compact, hand-held, tactical device capable of measuring the gamma dose-rate and gamma/neutron cumulative dose in a battlefield environment.

Its pocket size permits convenient use by troops on foot. Alarm pre-sets are provided for both the dose-rate and total dose modes. A push-button pad enables mode selection and functional control. Data readout is by liquid crystal display. It will replace the obsolete IM-93 quartz fiber dosimeter.

Multi-Function Radiation (MFR) Detector -Production

This program will develop improved radiation detection equipment to replace the current suite of logistically unsupportable assets. Present detectors (PAC-1S, AN/PDR-43 and AN/PDR-56F) have exceeded maintainability standards. Original manufacturers have either discontinued production or are no longer in business. An improved capability is required to support both wartime and peacetime nuclear accident response operations. A production contract was awarded in March 1995. First deliveries are expected in March 1997.

ADM-300A Multifunction Survey Meter

The ADM300A is a battery-operated, self-diagnostic, multiple functional instrument. It is used alone to locate and measure low and high intensity radioactivity in the form of gamma rays or beta particles. It is used with external probes to locate and measure alpha, beta, gamma, and x-rays, and neutron radiation.

SECTION 2. RDTE ITEMS

Automatic Detectors and Monitors

XM22 Automatic Chemical Agent Detector and Alarm (ACADA)

ACADA is a man-portable, point sampling alarm system that provides significant improvement over current capabilities; it detects, and identifies all nerve agents, mustard, and lewisite, by class. ACADA provides concurrent nerve and blister agent detection, improved sensitivity and response time, agent identification capability, improved interference rejection, extensive built-in test, a data communications interface, and the capability to be programmed for new threat agents. It replaces the M8A1 Alarm as an automatic point detector and augments the CAM as a survey instrument. The ACADA consists of an off-the-shelf non-developmental item (NDI), the GID-3 chemical agent alarm.

Agent Water Monitors

The Agent Water Monitor is a cooperative RDTE effort, chartered to develop a detection system which will detect chemical and biological agents in water. The detector will feature multi-agent capabilities, and operate automatically, improving both ease and response time of existing system. The project will accommodate the four services' requirements for the following:

In-line CB Detector (IL CBDWS)
Chemical Agent Water Monitor (CAWM)
CB Agent Water Monitor (CBAWM)

Rationale:

Army, Air Force, Marine Corps (Requirement)
Navy (Interest)

Key Requirements:

- Detect and identify chemical agents and agents of biological origin in water
- Perform monitoring automatically with continuous and batch sampling capabilities
- Easy to operate and support in forward areas, austere environments, and limited lighting

Description:

The Agent Water system will improve current water monitoring and purifying capabilities. It will automatically detect CB agents at or below harmful levels in water and not false alarm to common interferents. The system will be compact, man-portable and easy to use, and be decontaminated to a negligible risk level.

Joint Chemical Agent Detector (JCAD)

The JCAD is a fully cooperative RDTE effort, chartered to develop a chemical agent detector for a variety of mission requirements and service platforms. The detector will provide warfighters near-real time information on the presence of chemical agents so that meiosis or more severe effects can be avoided and not subvert the mission. The project will accommodate the four services' requirements for the following:

Individual Soldier Detector (ISD)
Special Operation Force Chemical Agent Detector (SOFCAS)
Individual Vapor Detector (IVD)
Aircraft Interior Detector (AIDET)
Shipboard Chemical Agent Monitor Portable (SCAMP)
CW Interior Compartment System (CWICS)
Improved Chemical Detection System (ICDS)

Rationale:

Army, Navy, Air Force, Marine Corps (Requirement)

Key Requirements:

- Small, lightweight detector capable of detecting presence of chemical agent vapors
- Capable of de-warning, allowing for rapid reduction of protective postures
- Detect, identify, quantify and warn of presence of even low levels of nerve or blister agents in vapor form in aircraft and shipboard interiors
- Operated/maintained by ship's force; operate in a shipboard environment

Description:

The JCAD will consist of: 1) a small lightweight device to be worn by individual personnel to warn them of a chemical agent attack; 2) a system that will detect, identify, quantify and warn of the presence of nerve agents and blister agents in vapor form in aircraft interiors; 3) a portable monitor, capable of detecting nerve agents and blister agents on personnel and in compartments, free of false alarms.

Biological Point Detection

Biological Point Detection is a fully cooperative acquisition effort chartered to develop new biological point detectors and detection systems for quad-services. The BIDS P3I effort will encompass development of an integrated system as well as several stand-alone biological detectors:

In addition, a Joint Biological Point Detection System (JBPDS) is under development. *JBPDS will be a system that can stand alone, or be used in a suite of systems.*

Biological Integrated Detection System (BIDS) -P3I

Rationale:

Army (Requirement)
Navy, Air Force, Marine Corps (Interest in BIDS' sub-components)

Key Requirements:

- Detect and identify 5 to 25 agent-containing particles/liter of air (ACPLA) in the 2–10 micron range in 15–30 minutes
- Provide agent detection and identification
- Provide collective protection with environmental controls (BIDS)
- Knowledge-based system to process detector information (BIDS)
- FM/HF radios to communicate (BIDS)
- Automatically identify biological pathogens and toxins (BD)
- Detect aerosol samples of specified materials (CAT A of ITF-6 Report) (BIDS)
- Reject common battlefield interferents and re-programmable to detect new agents (BD)
- Be data-linked with a centralized hazard information data collection center (BD)
- Characterize new agents; detect, identify, and semi-quantitative CB agents (CBMS)
- Respond to agent vapors, aerosols or liquid droplets (CBMS)
- Have chemical detection thresholds at or below human response levels (CBMS)
- Possess modules to accommodate future advances in technology and CB threat (CBMS)

Description:

BIDS uses a multiple technology approach, both developmental and off-the-shelf materiel, to detect biological agents with maximum accuracy. The BIDS P^3I system will integrate the CB Mass Spectrometer (CBMS) and the Biological Detector (BD) as sub-components.

The biodetector is an antibody based, device capable of identifying specific biological agents. It consists of electronics processing equipment, fluid processing modules, reservoirs for antibody reagents, and a light addressable potentiometric sensor to provide

biological agent identification. The total processing time, from insertion of sample to data readout, will be approximately 15 minutes at threshold concentrations. The biodetector includes an operator display which will provide identification and relative concentration of the biological agent detected. Built-in tests will also be provided to identify system malfunctions.

The CBMS detects and characterizes all known chemical and biological threat agents. It continuously and automatically detects threat agents via a mass analyzer chassis, a biological aerosol sampling probe, a surface sampling probe and sample identification device. The mass analyzer chassis houses the mass analyzer, pumps, control electronics, and computers. With the aerosol probe attached, the CBMS detects biological agent aerosols and chemical agents as aerosols and/or vapors in the air. With the ground probe attached, the CBMS detects chemical agents whether they exist as airborne vapors or aerosols, or as liquid droplets on surfaces. The CBMS will replace the MM1 and be mounted within the NBC Recon System to search for areas of CB agent contamination.

Air Base/Port Biological Detection Advanced Concept Technology Demonstration (ACTD)

Rationale:

Requirements identified by the Commander-in-Chief Central Command (CINCCENT) and Commander-in-Chief Pacific Command (CINCPAC)

Key Requirements:

- Field an interim system to sponsoring CINCs that provides rapid, automated biological attack detection and warning (5 to 10 minutes) to high value fixed sites (*e.g.*, ports and airfields)
- In addition to the biological detection system itself, provide the following "leave-behinds" or "residuals" to the fixed sites: an integrated command and control system to assist base personnel in rapid assessment, warning and dissemination of attack data; oral-nasal respirators for protection from any re-aerosolized agents after an attack, unmasking procedures; operational procedures
- Demonstrate candidate technologies and operational concepts that may both fill the CINCs immediate needs, and provide valuable "lessons learned" for future systems

Description:

While the BIDS and Long Range Biological Detection System (LR-BSDS) programs have made significant advances towards mitigating the effects of the worst case biological attack scenario (long line source releases – *e.g.*, an aircraft spraying agent along a course tens of kilometers long), it has been recognized that we still have potential vulnerabilities in protecting those high value fixed sites that will play critical roles in our force projection operations. Ports and airbases, by nature of their commonly known locations and high density of personnel, make lucrative targets for point source releases (*e.g.*, theater ballistic missiles, covert spraying by land and sea vehicles, or even man-portable disseminators). JPO-BD proposed taking available technologies, and through the non-standard acquisition process called ACTD, provide a limited number of detection systems to warfighting

CINCs. The concept has been to build an intelligent network of sensors based on the Navy's IBAD, but add to each sensor a generic biological detector module, location and meteorology modules. The detector network is able to both detect in near real time significant changes in background aerosol concentrations, but can also (less than 10 minutes) tell the operator located in the central command post (CP) whether the aerosol is composed of likely BW agents. Site personnel are then able to retrieve samples of the aerosol from the sensors for confirmatory identification of the BW agent. The ACTD will not only provide the detection and identification hardware and procedures, it will also provide leave-behinds for post attack actions, such as: inexpensive and light weight oral-nasal respirators to protect personnel from re-aerosolized BW agents but without all the stresses associated with full face respirators; decision aids and procedures for site decontamination; and procedures for determining when it's safe to remove protective gear. Testing of small scale detector network prototypes is underway; full scale testing of an entire network and other leave behinds will be done this Summer. Full scale deployment of the ACTD to CENTCOM and PACOM will begin in FY98.

Joint Biological Point Detection System (JBPDS)

Rationale:

Army, Navy, Marine Corps and Air Force (Requirement)

Key Requirements:

- Automatically detect, identify and warn of the presence of aerosolized biological warfare agents at levels of sensitivity, speed and reliability equal to or better than currently fielded detection systems (to include the BIDS P3I)
- Provide a common suite of biological detection equipment that can be applied to all four services' designated platforms
- Provide a man-portable version (Marine Corps)
- Be operable while on the move (Navy and Air Force)

Description:

JBPDS is the developmental system that will replace all existing NDI systems (BIDS, IBAD and Air Base/Port ACTD), and provide biological detection capabilities throughout the services, and throughout the battlespace. The common biological detection suite will consist of four functionalities: trigger (detects a significant change in the ambient aerosol in real time), collector (collects samples of the suspect aerosol for analysis by the JBPDS, and for analysis by supporting laboratories in the Communications Zone (COMMZ) and CONUS), detector (able to broadly categorize the contents of the aerosol and lend confidence to the detection process; *e.g.*, biological material in the aerosol or not, bacteriological, spore, protein, *etc.*), and identification (provides presumptive identification of the suspect BW agent and increases confidence in the detection process). These four functionalities will be integrated to allow fully automatic operation, and warning of a positive BW detection. The JBPDS program consists of two phases (Block I and Block II) to allow fastest possible fielding of a joint biological detection system, while at the same time preparing to take advantage of the rapid advances taking place in the

biological, information processing and engineering sciences. JPO-BD will award an Engineering and Manufacturing Development (EMD) contract this year for the development of Block I JBPDS prototypes for all four services. Production is anticipated to start in FY00, with first unit equipped in September, 2001. This joint acquisition strategy will allow for significant economies throughout the RDA process by eliminating duplicative efforts among the services, and greater logistic supportability in joint operations as each service will be able to support the other services' JBPDSs.

Shipboard Automatic Liquid Agent Detector (SALAD)

Rationale:

Navy (Service-Unique Requirement)

Key Requirements:

- Automatic detection of liquid chemical agents
- Operated/maintained by ship's force
- Operate in a shipboard environment and detect while the ship is underway

Description:

SALAD is an exterior, liquid agent point detection and monitoring system that will detect and alarm in the presence of liquid nerve and blister agents. SALAD will consist of a detector unit that uses chemically treated paper, optical scanners, a central processing unit and alarms (visual and audible) on the bridge and Damage Control Central.

Stand-Off Detection and Remote/Early Warning

Joint Service Lightweight Stand-off Chemical Agent Detector (JSLSCAD)

The JSLSCAD is a fully coordinated joint service RDTE program, chartered to develop a lightweight stand-off chemical detector for the quad-services. The JSLSCAD will utilize a passive infrared sensor with 360° scanning to satisfy requirements for:

Lightweight Stand-off Chemical Agent Detector (LSCAD)
M21 Moving Background
Chemical Agent Remote Detection System (CARDS)
Stand-off Detector for Armored System Modernization (SD/ASM)

Rationale:

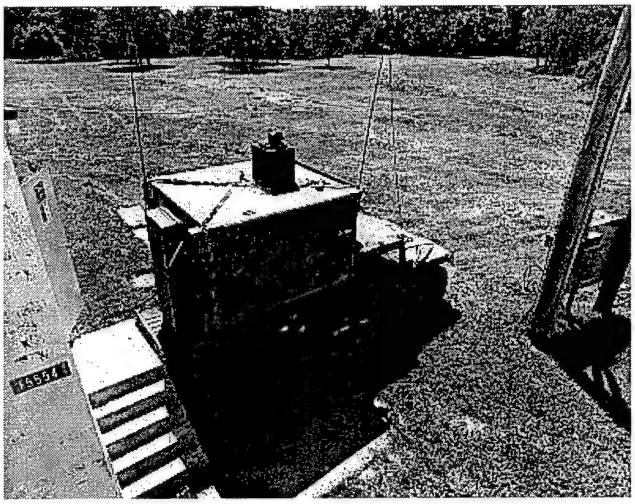
Army, Navy, Air Force, Marine Corps (Requirement)

Key Requirements:

- Automatically detect nerve or blister agents at a distance up to 5 km

- Be lightweight and employed from manned and unmanned systems
- Be capable of being data-linked with centralized hazard information data collection center
- Be capable of remote operations; aerial and on-the-move operation

Description:



JSLSCAD Mounted on Vehicle

The JSLSCAD will be capable of scanning 360° x 60°, and automatically detecting nerve or blister agents at a distance up to 5 km. The system will be light, compact and operate from a stationary position or on-the-move. The JSLSCAD Michelson interferometer employs a passive infrared system that will detect presence of chemical agents by completing a spectral analysis of target vapor agent chemical clouds.

Joint Service Chemical Warning and Identification LIDAR (JSCWILD)

The JSCWILD is a fully coordinated joint service program, chartered to develop a chemical warning and identification system for the quad-services. The JSCWILD will utilize an active LIDAR sensor to perform rapid agent identification and ranging to satisfy requirement for:

Laser Stand-Off Chemical Detector (LSCD)
Area Detection System (ADS)
Stand-off Detector (SD)
CB Stand-off Detector (CBSD)

Rationale:

Army, Air Force (Requirement)

Key Requirements:

- Automatically detect, range, and map CW agents at distances of up to 20 km
- Scan atmosphere and terrain to detect chemical vapors and airborne liquids and particles
- Provide stand-off capability for both fixed site and reconnaissance
- Provide rapid agent concentration mapping

Description:

The JSCWILD will be a lightweight, vehicle-mountable, contamination monitoring system which detects and quantifies, from a distance of 20 kilometers, all types of chemical agent contamination (including agent rain, vapors, and aerosols), in a stand-off mode. The JSCWILD will operate from fixed sites and ground vehicles. The system has distance-ranging and contamination-mapping capabilities and transmits this information to a battlefield information network.

Biological Remote/Early Warning

The Army's Long Range Biological Standoff Detection System (LR-BSDS) is a legacy system that is being incorporated into what is envisioned to be a family of early warning systems

The Joint Biological Remote Early Warning System (JBREWS) program is intended to give the warfighting commander a significantly shortened decision cycle regarding biological attacks; that is, the commander will see and be able to react to a biological attack much faster, thereby allowing many more personnel to take protective measures before they become exposed to the biological warfare agents. This means that fewer people will become casualties, and fewer people will have to take post-attack medical treatments.

Long Range Biological Standoff Detection System (LR-BSDS) P3I

Rationale:

Army (Requirement)
Air Force, Navy (Interest)

Key Requirements:

- Stand-off detection of aerosol clouds to a range of 50 km
- Provides relative concentration, range, location, and tracking of suspect aerosol clouds
- UH-60 helicopter-mounted

Description:

LRBSDS uses infrared light detection and ranging (IR-LIDAR) technology to detect, range and track aerosol clouds that are indicative of a BW attack; the LR-BSDS cannot discriminate biological from non-biological clouds. The system, which is approximately 800 pounds and three cubic meters, has three major components: a pulsed IR laser transmitter operating at infrared wavelengths; a receiver and telescope; and an information processor and display. This program, like the BIDS, has been designed in two phases; a NDI phase designed to rapidly field an interim capability, and a pre-planned product improvement (P3I) phase. The three NDI LR-BSDSs are already being fielded to their owning unit, the newly activated BIDS company (310^{th} Chemical Company (USAR)). The NDI system is able to detect and track man-made aerosols out to 30 km, but is non-eyesafe out to about 5 km. The P3I LR-BSDS will be eyesafe, will have a longer

operating range, and will be easier to operate. Three NDI LR-BSDSs have been fielded to the 310th Chemical Company. The first P3I LR-BSDSs will be fielded in time for the second BIDS company's activation in FY99.

The Joint Program Office for Biological Defense is leveraging the benefits of the ACTD program to greatly accelerate the development of the next generation of remote/early warning systems (i.e., systems other than the LR-BSDS). This new generation of detectors is referred to as the Joint Biological Remote/Early Warning System (JBREWS). JPO-BD is managing a JBREWS ACTD that will both address selected CINCs' needs, and will better refine our requirements and concepts regarding remote/early warning systems.

Joint Biological Remote/Early Warning System (JBREWS)

Rationale:

CENTCOM, EUCOM requirement (ACTD)
All services interest (ACTD and objective system)

Key Requirements:

- JPO-BD is currently sponsoring a series of concept studies with the Institute for Defense Analysis (IDA), and a Study Advisory Group (SAG) composed of CINC, service, and Joint NBC Defense Board representatives. This cooperative effort will define the requirements for the JBREWS ACTD
- The ACTD will formally start in FY98, with fielding of ACTD systems to selected CINCs around FY01
- Lessons learned from the JBREWS ACTD will assist the SAG in developing/refining its requirements document for the JBREWS objective system
- JBREWS objective system is expected to start fielding around FY03

Description:

JBREWS is expected to evolve into a "system of systems". That is, we will likely have standoff LIDAR systems like the LR-BSDS, and fairly dense arrays of miniaturized, rugged point detectors that possess only one or two of the functionalities that the much more robust JBPDS will have. The point detectors may be employed in a variety of ways: carried on vehicles, emplaced by hand around unit/site perimeters, remotely emplaced by aircraft, or possibly even delivered by artillery or rocket systems to project the sensors into contested or enemy controlled areas. What is becoming clearly evident from our studies is that the systems need to be networked together to provide the greatest confidence of accurate detection and fastest warning, and that they need to be employed in fairly high numbers to ensure point releases are not missed.

Joint Service NBC Reconnaissance System (JSNBCRS)

The Joint Service NBC Reconnaissance program is a coordinated Army and Marine Corps effort and will yield improved reconnaissance capabilities for both heavy and lightweight vehicle platforms. It will satisfy requirements for:

M93A1 NBC Reconnaissance System (NBCRS)
System Improvement Phase (SIP) - Production
Light NBC Reconnaissance System (LNBCRS)
Lightweight Reconnaissance System (LWRS)

Rationale:

Army, Marine Corps (Requirement)

Key Requirements:

- Armored vehicle with over-pressure collective protection and macro cooling
- Chemical agent stand-off and point detectors and monitors
- Radiation detector and monitor
- Integrate central data processor with all detectors and monitors; navigation and communications system; jam resistant communications system; meteorological sensing system
- Integration of advance NBC detection and analysis equipment suited for Marine Air-Ground Task Force (MAGTF) operations (LNBCRS)
- Standard Marine Corps host vehicle, transportable by C-130, CH-53E, and LCAV-30 (LNBCRS)

Description:

The LNBCRS will provide a premiere vehicle for accurate, rapid NBC combat hazard information by verifying the absence of, finding, mapping, and marking radiological, biological, and chemical hazards. The LNBCRS will be an integration of advanced NBC detection and analysis equipment suited for Marine Air-Ground Team Force expeditionary operations and Army rapid deployment/light operations.

Joint Service Warning and Reporting Network (JWARN) (FUE FY 99)

Rationale:

Army, Air Force, Navy and Marine Corps (Requirement)

Key Requirements:

- Capable of interfacing with all NBC detectors and sensors
- Capable of interoperability with all service command and control systems
- Capable of generating NBC reports
- Capable of automatic transmission of NBC alarm and data
- Capable of vehicle operation

Description:

Consolidation of HAZWARN (warning and reporting) with MICAD to form a comprehensive upgradable NBC component to the emerging C^4I systems in the services. System does not duplicate C^4I fractures but integrates into the global command and control system to provide automated NBC warning and NBC mission planning function.

ANNEX B

NON-MEDICAL FORCE PROTECTION PROGRAMS

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SECTION 1: FIELDED AND PRODUCTION ITEMS

Respiratory

M17A2 Protective Mask

The M17A2 Protective Mask consists of a natural blend rubber face piece; two activated charcoal filters mounted within cheek pouches; a voicemitter to facilitate communications, a drinking tube; eyelens outserts to protect the mask's integral eyelens and reduce cold weather fogging; an impermeable hood; and a carrier for the mask, its components, and medical items (such as the Nerve Agent Antidote Kit). The Army and Marine Corps are replacing this mask with the M40 protective mask. The Air Force and Navy have replaced it with the MCU-2A/P.

ABC-M24 Aircraft Protective Mask

This protective mask provides the wearer protection from NBC aerosols/vapors both in aircraft, and on the ground. The mask consists of: wide view, clear plastic lens embedded in a butyl rubber face blank; an integral microphone; eyelens outserts; carrying case; anti-fog kit; and a hose mounted filter canister. The mask has a microphone connection to fit the aircraft communications systems. The M24 has an adapter that allows coupling to the aircraft's oxygen supply system. The M24 is being replaced by the M49 and XM45 masks.

M25A1 Tank Protective Mask

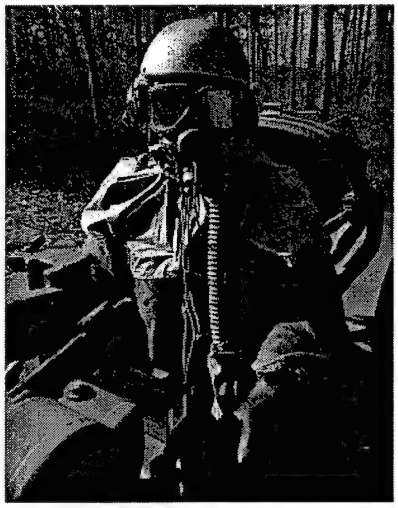
This protective mask provides the wearer protection from NBC aerosols/vapors both in the vehicle/aircraft, and on the ground. The mask consists of: wide view, clear plastic lens embedded in a butyl rubber face blank; an integral microphone; eyelens outserts; carrying case; anti-fog kit; and a hose mounted filter canister. The mask has a microphone connection to fit the armored vehicle communications systems. The M25A1 has an adapter that allows it to be coupled to the tank's filtered and temperature controlled Gas Particulate Filtration Unit (GPFU). The M25A1 is being replaced by the M42/M42A1/M42A2 protective mask.

MCU-2A/P Protective Mask

The MCU-2A/P provides eye and respiratory protection from all chemical and biological agents as well as radioactive particulate material. The mask uses a replaceable, standard NATO filter canister which is mounted on either side of a wide-view optical quality visor. The mask provides improved fit, comfort, and visibility relative to earlier masks, and includes a drinking tube for attachment to the standard canteen, and voicemitter for improved communications.

M40/42 Series Protective Mask

The M40/42 protective masks provide eye-respiratory face protection from tactical concentrations of CB warfare agents, toxins and radioactive fallout particles. The mask consists of a silicone rubber face piece with an in-turned peripheral face seal and binocular rigid lens system. It accommodates NATO standard canisters which can be worn on either cheek of the mask. The M40 is designed for the individual dismounted ground warrior, while the M42 is designed for combat vehicle crewmen. Recent improvements include a second skin hood and laser-safe eye lens outserts.



M43 Protective Mask

The M43 Aviator Mask consists of a form-fitting face piece with lenses mounted close to the eyes; an integral CB hood and skull-type suspension system; an inhalation air distribution assembly for air flow regulation, lenses and hood; and a portable motor/blower filter assembly which operates on either battery or aircraft power. The M43 Type I was developed for the AH-64 aviator and is compatible with the AH-64 Integrated Helmet and Display Sight System and the Optical Relay Tube. The M43 Type II is intended for the general aviator.

M48/49 Protective Masks - Production

The M48/M49 are third generation M43 series masks. The M48 mask replaces the M43 Type I mask and will be the only mask for the Apache aviator for the foreseeable future. The M49 mask, along with the XM45 mask will replace the M24 and M43 Type II masks. The M48 and M49 masks consist of a lightweight motor blower, a new hose assembly, a web belt, the mask carrier, facepiece carrier, eyelens cushions, and the facepiece of the M43A1. The M49 mask will be replaced in the mid-term by the XM45 Aircrew Protective Mask which does not require a motor blower unit.

Aircrew Eye/Respiratory Protection (AERP)

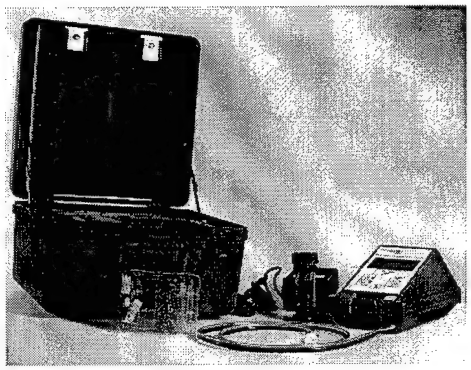
The AERP (replaces the MBU-13/P system for aircrews) is a protective mask which enables aircrews to conduct mission operations in a chemical-biological environment. The AERP system includes a protective hood assembly with a standard MBU-12/P mask, an intercom for ground communication, and a blower assembly that provides de-misting. The blower is stowed during flight operations on a bracket that is mounted inside the aircraft.

A/P22P-9(V) - Production

The A/P22P-9(V) provides head-eye-respiratory protection via the MCK-3/P respirator and CQK-8/P tactical ventilator for "helo" crews. The ensemble, which utilizes a blower to provide positive pressure, has anti-drown features and provides system compatibility with a large variety of aircraft. In FY96, the ensemble was upgraded with a rip away face plate, and improved tactical ventilator with a smaller man-mounted pusher fan.

Ancillary Mask Equipment

M41 Protection Assessment Test System



The M41 Protective Assessment Test System (PATS) enhances operational capability by validating proper fit of the mask to the face of the individual. The PATS is a new capability that provides a simple, rapid, and accurate means of validating the face piece fit of protective masks.

Voice Communication Adapter

The Voice Communication Adapter (VCA) is a low risk program providing additional capability to the M40/42 mask. The VCA is a joint program between the USMC and US Army.

Universal Second Skin

The Universal Second Skin is one of the components of a pre-planned product improvement in the M40/M42 series mask. This program is a Joint U.S. Army/U.S. Marine Corps effort. Both developed prototype designs and, after field user and human engineer testing, the Marine Corps design was selected as the best. The Air Force is developing a second skin for the MCU-2A/P.

Battlefield Protective Suits

Battle Dress Overgarment (BDO)

The BDO is a camouflage patterned (desert or woodland), two piece, air permeable overgarment typically worn over the duty uniform. The overgarment material consists of an outer layer of nylon cotton, and an inner layer of charcoal impregnated polyurethane foam. The BDO provides protection against chemical agent vapors and liquid droplets, biological agents (to include toxins), and radioactive alpha and beta particles. The BDO is issued in a sealed vapor-barrier bag that protects the garment from rain, moisture and sunlight. The BDO provides chemical protection for 22 days (extendible by commanders with increased risk to the wearer), and should be replaced within 24 hours of contamination by liquid chemical agents.

Chemical Protective (CP) Suit, OG MK-III (Navy Suit)

The Chemical Protective Overgarment (CPO) protects the wearer against all known chemical and biological agents which present a percutaneous hazard. The suit consists of a smock and separate pair of trousers, and is sized to accommodate the 5 percentile female through the 95 percent male ratio. This garment will be replaced Navy-wide beginning in calendar year 1997 by a superior suit developed under the auspices of the Joint Service Lightweight Integrated Suit Technology (JSLIST) program. The Mark III chemical, biological, radiological (CBR) suit protects against chemical agent vapors, aerosols, droplets of liquid, and biological agents. The suit consists of separate smock and trousers in addition to gloves and overboots.

CP Suit, Saratoga (USMC)

Like the BDO, the SARATOGA CP Suit is an air permeable, camouflage patterned overgarment. Instead of carbon impregnated foam, SARATOGA uses spherical, activated carbon adsorbers immobilized in the liner fabric. This system allows for a lighter, cooler garment. The carbon spheres are also specially treated to minimize water absorption, resulting in a garment that is practically insensitive to humidity and perspiration, and allows for repeated laundering of the garment.

CWU-66/P Aircrew Ensemble - Production (FUE FY96)

The CWU-66/P, a one-piece flightsuit configuration, provides 24-hour protection against standard NATO threats. It is made with Von Blucher carbon spheres, and is less bulky than prior ensembles. It offers a reduced thermal load burden and is compatible with aircrew life support equipment.

Chemical Protective Undergarment (CPU)

The CPU is a two-piece lightweight undergarment made of a non-woven fabric with activated charcoal. When worn under the combat vehicle crewmen (CVC) coverall, battle dress uniform (BDU), the CPU provides 12 hour protection at NATO standards after moderate non-NBC field wear and one laundering.

Aircrew Uniform, Integrated Battlefield (AUIB)

The AUIB is a two-piece duty uniform which provides aircrew with flame and CB protection in a single uniform. It provides 24 hour protection at NATO standards after moderate wear. The AUIB, which replaces the BDO for aircrew, is worn over the Nomex flight suit. The outer shell is a laminate of 95/5 Nomex/Kevlar and polytetrafluoroethylene film. The inner layer is a laminate of carbon impregnated, flame resistant polyurethane foam and nylon knit. The AUIB is compatible with life support equipment used in rotor-winged aircraft and with developmental cooling vests.

Specialty Suits

Suit Contamination Avoidance Liquid Protection (SCALP)

The SCALP is a lightweight overgarment which provides liquid splash protection to undergarments. The SCALP, which consists of a jacket with hood and trouser, is made from a blend of Gore-tex and butyl rubber-coated nylon.

Interim-Self Contained Toxic Environment Protective Outfit - (STEPO-I)

Approved as an interim system for 2-hour depot operations in Immediate Danger to Life and Health (IDLH) environments. It consists of encapsulating suit made of butyl rubber-coated nylon with a polycarbonate visor. Respiratory protection is provided by one of two options--tethered clean air supply or a self-contained rebreather worn as a back-pack. Cooling is provided by an ice vest worn underneath the suit.

Protective Accessories

Green/Black Vinyl Overboots (GVO/BVO)

The GVO/BVO are fitted vinyl overshoes that can be used by the wearer for protection against nuclear agents, biological agents, chemical agents, or foul weather. The impermeable GVO/BVO provide protection against all known chemical agents for up to 14 days and should be replaced within 12 hours of contamination by a liquid agent (extendible by commanders to 24 hours with increased risk to wearer). The GVO/BVO may be decontaminated to extend their usefulness.

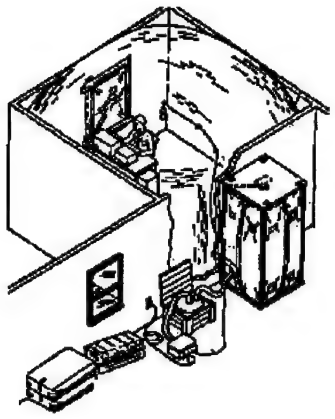
CP Gloves

The CP glove set consists of a butyl-rubber outer glove for protection from chemical agents, and a cotton inner glove for perspiration absorption. CP outer gloves come in three thicknesses: 7, 14, and 25 mil. The 7 mil glove is used by personnel who require a high degree of tactility, such as medical and personnel engaged in electronic equipment repair. The 14 mil glove is used by personnel like aviators and mechanics, in cases when good tactility is necessary and stress to the glove is not too harsh. The 25 mil glove is used by personnel who require a durable glove to perform close combat tasks and heavy labor. The 14 and 25 mil glove sets will provide protection for at least 24 hours, and can be decontaminated to extend their usefulness. The 7 mil glove set should be replaced within 6 hours of exposure to a chemical agent.

Collective Protection Equipment

M51 Protective Shelter, CB

The M51 shelter is a trailer mounted system that consists of the following major components: a 10 man shelter, a protective entrance, and a support system. The shelter and protective entrance support themselves through air filled ribs. The protective entrance minimizes carry-over of vapor contamination from outside to inside the shelter, and paces entries to the shelter to prevent loss of shelter over-pressure. The air handling system is permanently mounted in the trailer, and provides forced, filtered, and environmentally conditioned air to the shelter. The M51 is mostly used by battalion aid stations and other medical units. It can also be used as a temporary rest and relief shelter. The Marine Corps has recently fielded a stand-alone collective protection shelter (The Portable Collective Protection Shelter). This system can be erected and employed by 4-6 personnel in approximately one hour. This system provides heat stress relief from the effects of MOPP for 12-14 personnel.



M20 Simplified Collective Protective Equipment

The M20 SCPE is used to convert an interior room of an existing structure into a positive overpressure, NBC collective protection shelter where individuals can perform assigned missions without wearing the protective mask and overgarment. The system consists of a liner, protective entrance, filter canister, and support kit.

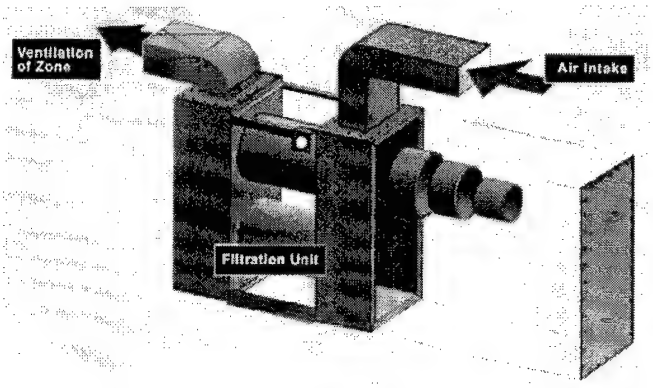
M20A1/M28 Simplified CPE (SCPE)

The SCPE is a low cost method of transforming a room of an existing structure into an NBC collective protection shelter for command, control and communication (C^3) and soldier relief functions. M20A1 is a room liner for existing shelters; M28 is a liner for the TEMPER tent. Components include a CB vapor resistant polyethylene liner that provides a protected area in an existing structure; a collapsible, protective entrance that allows entry to/exit from the protected area; a hermetically sealed filter canister that provides filtered air to both the liner and the protective entrance; and a support kit that contains ducting, lighting, sealing and repair material and an electronically powered blower. A pre-planned product improvement (P^3I) program to the SCPE (M20A1/M28) provides liquid agent resistant liners, protective liners for tents, interconnectors, and an interface with environmental control units. The improved SCPE also allows more people to enter at one time, and protects hospitals under tents.

Shipboard Collective Protection System - Production

Shipboard CPS is an integral part of the HVAC systems on new construction ships. CPS provides each protected zone on the ship with filtered air at an overpressure of 2.0 inches Hg. CPS is modular and is based on a Navy-improved version of the 200 cfm M56 filter. CPS includes filters, filter housings, high pressure fans, airlocks, pressure control valves, low pressure alarm system, and personnel decontamination stations.

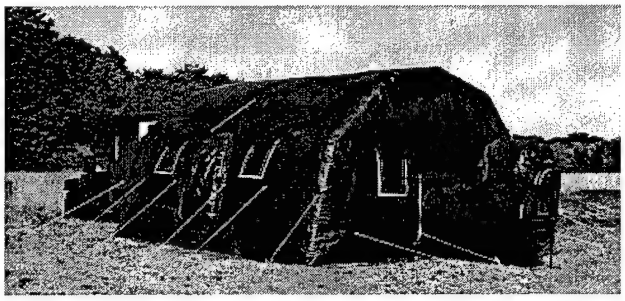
Selected Area Collective Protection System - Production



Selected Area CPS (SACPS) is designed to be easily adaptable to current ships to provide selected spaces (*i.e.*, command and control, berthing areas, *etc.*) with an affordable CPS system. SACPS is modular and is based on a Navy-improved version of the 200 cfm M56 filter. SACPS is easily integrated into the ship's existing HVAC system, and includes filters, filter housings, a high pressure fan, an airlock, a pressure control valve, and a low pressure alarm system.

CB Protected Shelter (CBPS) - Production

The CB protected shelter provides collective protection (300 sq. ft.) for medical and selected combat, combat support, and combat service support personnel to perform missions in a CB environment. The CB protected shelter is highly mobile, and easy to set up and take down to accommodate the dynamic integrated battlefield.



Gas particulate Filters; M48, M56, M1A1-19, M2A2

Gas Particulate filters remove toxic gas and dust from air supplied to collective protection systems and armored vehicle overpressure systems.

SECTION 2: RDTE ITEMS

Integrated

Force XXI Land Warrior

Rationale:

Army (Requirement)
Navy, Air Force, Marine Corps (Interest)

Key Requirements:

- Protection from all threats for the individual, to include NBC threats
- Integrated vision, communication, and locator systems and enhanced equipment interface

Description:

The Force XXI Land Warrior (formerly, the 21st Century Land Warrior) is an integrated soldier defense system which will improve the warfighter's combat system interface and ability to detect, recognize, and destroy enemy soldiers and equipment. Monitor and protection systems are integrated into a full body ensemble along with advanced locations, communications, microcomputer, and vision systems to maximize the warfighter's battlefield awareness, survivability, and lethality.

Respiratory

CB Respiratory System (A/P23P-14(V)N) NDI

Rationale:

Navy, Marine Corps (Requirement)

Key Requirements:

- CB protection compatible with all aircraft system; integral respirator and protective ensemble

Description:

The A/P23P-14(V)N is a self contained protective ensemble designed for all forward deployed fixed wing (USN/USMC) and rotary wing (USN) aircrew. The design will incorporate filter dual air/oxygen supply and a cross-over manifold with ground flight selector switch to provide filtered air for hood ventilation, and filtered air for oxygen for breathing. The system will provide enhanced protection and offer anti-drown features.

M45 Aircrew Protective Mask (ACPM) (FUE FY98)

Rationale:

Army (Requirement)
Navy, Air Force, Marine Corps (Interest)

Key Requirements:

- Unpowered protection compatibility with optical sighting systems
- Reduced weight, cost and logistic burden
- Improved RAM

Description:

The ACPM will have close fitting eyelenses mounted in a silicone rubber facepiece with an in-turned peripheral seal, a detachable hood system, and a detachable motor blower assembly to reduce the inhalation burden. The mask will provide the required CB protection with or without forced ventilated air, and is compatible with aircraft sighting and night vision devices.

Battlefield Protective Suits

Joint Service Lightweight Integrated Suit Technology (JSLIST)

The JSLIST program is a fully cooperative RDTE effort chartered to develop new CB protective suits and garments for all services. The program will yield a family of garments and ensembles, developed for Joint Service mission needs and tested to Joint Service standards. The JSLIST will provide enhanced CB protective ensembles with reduced physiological heat burden and will be generally lightweight and launderable. These garments will also integrate other types of protection. JSLIST is the first of a 3 phase program and supports a variety of Service suit and accessories requirements including:

Enhanced Aircrew Uniform Integrated Battlefield (EAUIB)
Lightweight CB Protective Garment (LWCBG)
Vapor Protective Flame Resistant Undergarment (VPFRU)
Advanced Chemical Protective Garment (ACPG)
Groundcrew Ensemble (GCE)

There are five JSLIST clothing item requirements:
1) overgarment, 2) duty uniform, 3) undergarment, 4) boots and 5) gloves. Each of the Services' requirements are incorporated by these five JSLIST requirements.

JSLIST Overgarment

Enhanced Aircrew Uniform Integrated Battlefield (EAUIB) (FUE FY97)

Rationale:

Army (Requirement)
Navy (Interest)

Key Requirements:

- Provide 12 hours protection (24 desired) against 10 g/m^2 liquid; 10,000 CT vapor/aerosols
- Provide 30 days field wear (minimum) in all geographical areas
- Retain CB protection after 4 launderings
- Provide flash fire protection (10 $watts/cm^2$ for 6 seconds)
- Provide lower physiological heat burden and 25% less than the AUIB
- Be compatible with micro climate cooling vest

Description:

The EAUIB provides protection against all CB agents after laundering and extended periods of non-CB wear. It will be worn by aircrew and aviation ground personnel. It will combine CB and flame protection in a single garment. The EAUIB is a two-piece suit design with an integrated hood compatible with M43 and XM45 series masks and second skins. It may be worn as an overgarment for the duty uniform or as a primary garment over underwear.

Lightweight Chemical/Biological Protective Garment (LCBPG) (FUE FY97)

Rationale:

Army (Requirement)
Navy, Air Force (Interest)

Key Requirements:

- Provide 6 hours protection against 10 g/m^2 liquid; 5000 CT vapor/aerosols
- Provide 7 days field wear (minimum) in all geographical areas (launderability not required)
- Weigh no more than 4 pounds (3 desired)
- Have package volume for size medium no more than 500 in^3 (300 desired)
- Reduce the physiological heat burden of the BDO by at least 20% (30% desired)

Description:

In test conditions, the LCBPG provided 6 hours of protection against all CB agents after laundering and moderate periods of non-CB wear. The requirement has a trade-off of wear-time and protection-time in order to achieve a lightweight, low-bulk garment for short term, risk-taking missions. The LCBPG will be a two-piece suit design with an

integrated hood compatible with the M40 mask with second skin. It will be worn as an overgarment for the duty uniform or as primary garment over underwear depending upon the environment or mission.

Advanced Battle Dress Overgarment (ABDO) (FUE FY97)

Rationale:

Army (Requirement)
Navy, Marine Corps (Interest)

Key Requirements:

- Provide 24 hours protection against 10 g/m^2 liquid agent; 5000 CT vapor/aerosols
- Provide 30 days field wear (minimum) in all geographical areas
- Retain chemical protection after 4 launderings
- Weigh less than 4 lbs for a size medium-regular, packed garment
- Reduce physiological heat burden currently imposed by BDO

Description:

The ABDO will provide 24 hour protection after extended wear and laundering. Liners currently are based upon activated carbon technology (carbon beads, thin carbon foam and others). The ABDO will be a two-piece design with an integrated hood compatible with the M40 mask with second skin. It will be worn as an overgarment for the duty uniform or as a primary garment over underwear depending upon the environment and mission.

Advanced Chemical Protective Garment (ACPG) (FUE FY97)

Rationale:

Navy (Requirement)

Key Requirements:

- Provide 24 hours protection against 10 g/m^2 liquid agent; 5000 CT vapor/aerosols
- Provide 30 days field wear (minimum) in all geographical areas
- Retain chemical protection after 4 launderings
- Weigh less than 4 lbs for a size medium-regular, packed garment
- Reduce physiological heat burden currently imposed by BDO

Description:

The ACPG will provide 24 hour protection after 30 days wear time and 4 launderings. Liners currently are based upon various activated carbon technologies (carbon beads, thin carbon foam and others). It will be two-piece suit with an integrated hood compatible with the MCU-2/P mask with second skin. The ACPG will be worn as an overgarment for the duty uniform or as a primary garment over underwear depending upon the environment and mission.

JSLIST Undergarment

Vapor Protective Flame Resistant Undergarment (VPFRU) (FUE FY97)

Rationale:

Army (Requirement)

Key Requirements: (When worn under the Nomex coveralls)

- Provide 12 hours protection (24 desired) against 10 g/m^2 liquid; 10,000 CT vapor/ aerosols
- Provide 30 days field wear (minimum) in all geographical areas
- Retain chemical protection after 4 launderings (10 desired)
- Provide flash fire protection (10 $watts/cm^2$ for 6 seconds)
- Weigh less than 3 pounds (without coveralls)
- Reduce by 20% the physiological heat burden imposed by the CPU worn with coveralls

Description:

The VPFRU will provide 12 hour protection after extended wear and laundering. It will also offer a reduction for the heat stress burden when compared to the CPU. The VPFRU will be a one or two-piece undergarment with an integral hood compatible with the M42 series mask.

Duty Uniform

Groundcrew Ensemble (GCE)

Rationale:

Air Force (Requirement)

Key Requirements.

- Enhance existing capability with lighter, less thermal burdening ensemble

Description:

The GCE provides chemical protection, from the neck down, to personnel while in an Air Base environment. It provides protection from liquid and vapor hazards while greatly reducing the level of physiological stress encountered with the current battle dress overgarment (BDO). The material, which will be lighter and will provide a reduction in heat stress, will be capable of being laundered and decontaminated.

CB Protective Firefighter Ensemble (FFEN)
Fire Fighter Suit-Combat (FIS-C)
Joint CB Protective Firefighter Suit (J-Fire)

Rationale:

Army, Air Force (Requirement)

Key Requirements:

- Provide 12 hours of CB agent protection against 10 g/m^2 liquid agent
- Provide firefighters CB protection in both structural and crash fire fighting/rescue operations
- Allow firefighters to use mission essential tools and equipment
- Provide resistance to water and all standard fire fighting chemicals (foam, CO_2, aircraft POL)
- Capable of being donned in 3 minutes or less

Description:

The ensemble will consist of CB undergarment worn under the standard fire fighting outer garment and used with a switchable filtered/supplied air respiratory system (same as for the Improved TAP ensemble). Four types of CB undergarments are being evaluated, including the J-Fire which is being developed by the Air Force under the JSLIST program and will meet FFEN requirements.

JSLIST Boots

Multipurpose Overboot (MULO)

Rationale:

Army, Air Force, Marine Corps (Requirement)
Navy (Interest)

Key Requirements:

- Provide 24 hours protection against 10 g/m^2 liquid agent as well as environmental protection from water, snow and mud
- Provide 60 days wear in all environments without degradation of protection
- Provide resistance to incidental slashing by POL and self-extinguishing flame resistance
- Capable of being decontaminated to an operationally safe level using standard decontaminants

Description:

The MULO is a joint service program under the auspices of the JSLIST program. It will be made of an elastomer blend and will be produced by injection molding. It will be designed for wear over the combat boot, jungle boot and intermediate cold/wet boot. The MULO will be more durable, lighter weight and will provide more protection than the

GVO/BVO. The sole will be designed to provide traction on various surfaces including dirt and metal.

JSLIST Gloves (JSLIST P3I)

Improved CB Protective Glove

Rationale:

Army (Requirement)
Navy, Air Force, Marine Corps (Interest)

Key Requirements:

- Provide 24 hours protection against 10 g/m^2 liquid agent
- Provide protection against POL and standard decontaminants
- Provide self-extinguishing flame resistance
- Provide 15 days wear durability in all environments without degradation of protection
- Provide dexterity equal to or better than the standard 14 and 25 mil butyl gloves

Description:

The Improved CB Protective Glove will be a joint service program under the auspices of the JSLIST program. Candidate materials include a flame retardant (FR) butyl rubber; polyepichlorohydrin/FR butyl rubber; and an experimental, permeable material.

Specialty Suits

Improved Toxicological Agent Protective (I-TAP)

Rationale:

Army, Air Force (*i.e.,* EOD Ensemble) (Requirement)
Navy, Marine Corps (Interest)

Key Requirements:

- Provide 4 hours liquid chemical agent protection at 10 g/m^2
- Provide wear durability equal to current TAP suit
- Be compatible with M40 Special Purpose Mask and Hood and TAP boots and gloves
- Provide a 1-hour supplied air bottle with capability for switching to filtered air respirator
- Be light in color to reduce solar load and offer a universal cooling system pass through

Description:

The I-TAP will enhance existing capabilities with a lighter, less thermal burdening ensemble. The fabric will be self-extinguishing and decontaminated after a minimum 5 reuses. The I-TAP will support short term entry and life saving operations requiring supplied air. The respiratory system will weigh under 25 lbs., and air bottles will be

replaceable while the suit is worn. The I-TAP will have an improved design with seals at the neck and cuffs to eliminate bellows effect. The suit will have a voicemitter and a pass through for cooling systems.

Collective Protection Equipment

Advanced Integrated Collective Protection System (AICPS) for Vehicles, Vans and Shelters (VVS)

Rationale:

Army (Requirement)
Navy, Marine Corps (Interest)

Key Requirements:

- Integral NBC filtration power and environmental control for vehicles, vans and shelters
- Minimize filter changes and overall system logistics burden
- Reduced size, weight and energy requirements

Description:

The AICPS which uses deep-bed carbon, is an NBC filtration system integrated with an environmental control unit and auxiliary power unit for combat systems. The combined components provide overall size, weight and energy reduction, and eliminate the need for additional electrical power for the host system.

Improved Shipboard Collective Protection System

Rationale:

Navy (Service-Unique Requirement)

Key Requirements:

- Integrated CB hardening

Description:

The ICPS will increase the shipboard filter life of the Shipboard Collective Protection System (from the current one or two years) to at least a three year service life, providing millions of dollars of savings in life cycle costs.

ANNEX C

DECONTAMINATION PROGRAMS

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SECTION 1: PRODUCTION AND FIELDED ITEMS

Personnel

M258A1 Skin Decontamination Kit (SDK)

The M258A1 (see figure D-1) consists of a pocket-sized plastic case containing three sets of foil-packaged decontaminating wipes. The decontaminating sets consist of PACKET 1 containing an aqueous decon solution soaked gauze pad, and PACKET 2 containing a decon solution filled glass ampoule within a gauze pad. Personnel use the two wipes successively to remove and neutralize liquid chemical agents from their skin, clothing, personal equipment and weapons. The M258A1 is being replaced by the M291 decon kit.

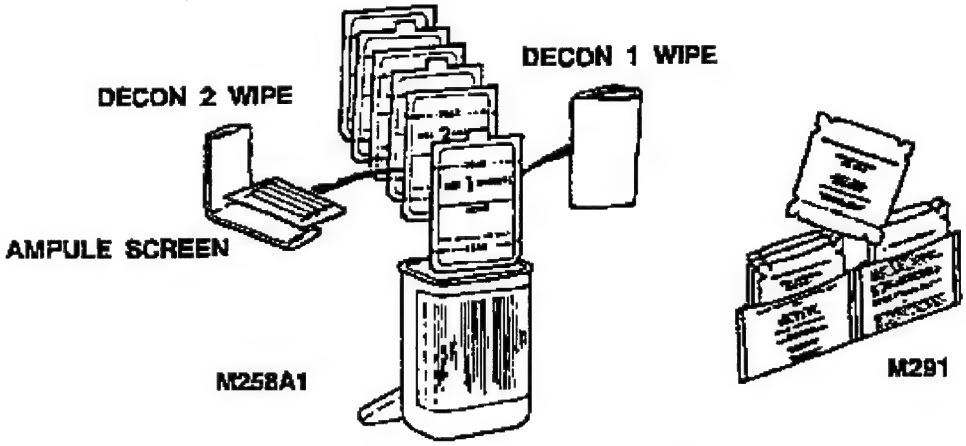


Figure D-1. Skin Decontamination Kits

M291 Skin Decontamination Kit

The M291 (see figure D-1) consists of a wallet-like flexible carrying pouch containing individually packaged hermetically sealed foil packets. Each packet contains a folded nonwoven fiber applicator pad with an attached strap handle on one side. The pad contains a reactive and sorptive resin polymer mixture. The kit enables warfighters to remove, neutralize, and destroy chemical and biological warfare agents on contaminated skin. The kit is carried in a pocket of the Battle Dress Overgarment (BDO).

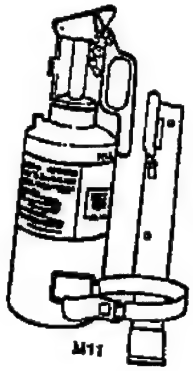
M295 Equipment Decontamination Kit

The M295 consists of a pouch containing four individual wipedown mitts, each of which is within a soft, protective packet. The pouch assembly is designed to fit comfortably within the pocket of the BDO. Each individual wipedown mitt in the kit is comprised of adsorbent resin contained within a nonwoven polyester material and a polyethylene film backing. In use, resin from the mitt is allowed to flow freely through the non-woven polyester pad material. Decontamination is accomplished through sorption of contamination by both the non-woven

polyester pad and by the resin. The M295 enables the warfighter to perform basic decontamination to remove, neutralize, or destroy CB warfare agents and toxins on contaminated personal and load bearing equipment.

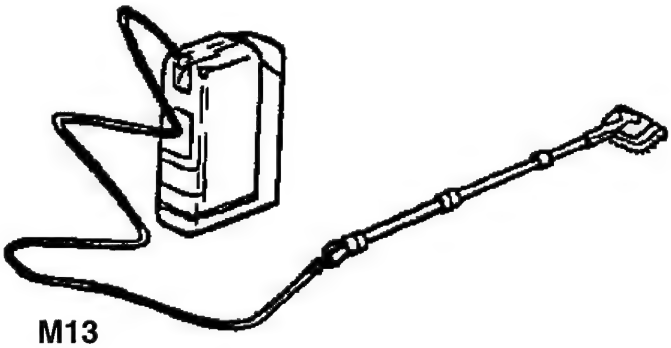
Combat Equipment, Vehicles, and Aircraft

ABC-M11 Portable Decontaminating Apparatus



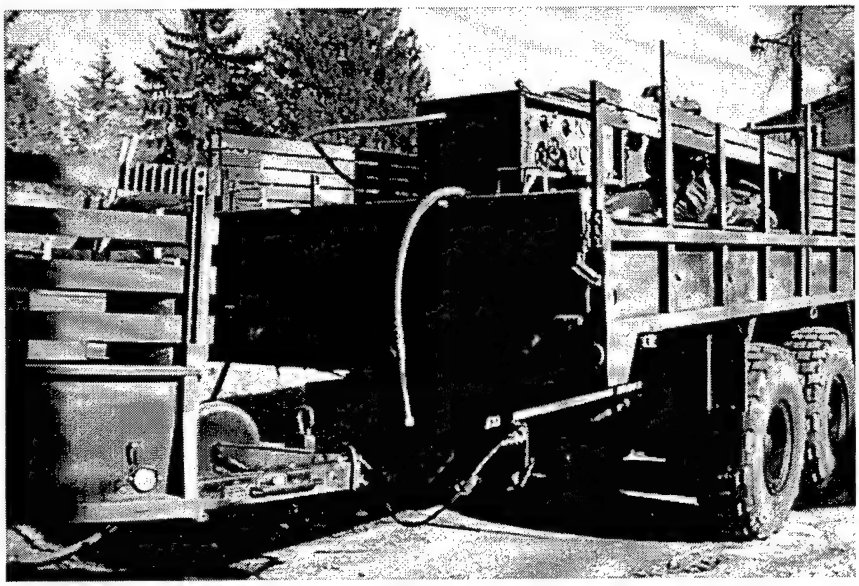
The 1-$^{1}/_{2}$ quart capacity M11 is used to spray DS2 decontaminating solution onto critical areas (*i.e.*, frequently used parts) of vehicles and crew served weapons. The M11 consists of a steel cylinder, a spray head assembly, and a small nitrogen cylinder (about 3" long). The refillable M11 can produce a spray 6 to 8 feet long, and cover an area of about 135 square feet. The M11 is currently used on tanks and other systems where the larger M13 Decontaminating Apparatus, Portable (DAP) cannot be effectively stowed.

M13 Decontaminating Apparatus, Portable (DAP)



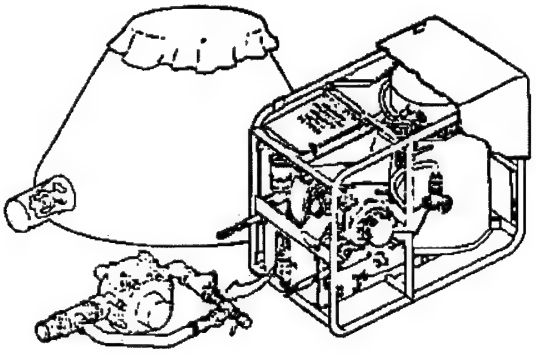
The man portable M13 consists of a vehicle mounting bracket, a pre-filled fluid container containing 14 liters of DS2 decontaminating solution, and a brush-tipped pumping handle connected to the fluid container by a hose. The fluid container and brush head are both disposable. The M13 can decontaminate 1,200 square feet per fluid container. The combination of spray pump and brush allows personnel to decontaminate hard to reach surfaces, and remove thickened agent, mud, grease and other material.

ABC-M12A1 Power Driven Decontamination Apparatus (PDDA); Skid-Mounted



The M12A1 consists of three main components: a pump unit, a 500 gallon tank unit, and a 600 gallon per hour liquid fuel water heater. The M12A1 is a flexible system that can be used for purposes such as de-icing, fire fighting with water or foam, water pumping/transport, and personnel showering in addition to equipment and area decontamination. The M12A1 can pump 50 gallons of decontaminating solution per minute through both of its two hoses. The integral shower assembly provides 25 shower heads. The M12A1 is typically mounted on a 5 ton truck for tactical mobility, but can be dismounted to facilitate air transport. The Marine Corps is replacing the M12A1 PDDA with the M17 series Lightweight Decontamination Apparatus.

M17 Series Lightweight Decontamination Apparatus



The M17 series Lightweight Decontamination System is a portable, lightweight, compact engine driven pump and water heating system. The system is used during decontamination operations. The LDS is capable of drawing water from any source and delivering it at moderate pressure and controlled temperatures. The system has an accessory kit with hoses, spray wands, and personnel shower hardware. It also includes a collapsible water tank.

SECTION 2: RDTE ITEMS

Combat Equipment, Vehicles, and Aircraft

Sensitive Equipment Decontamination System

Rationale:

Army (Requirement)
Navy, Air Force, Marine Corps (Interest)

Key Requirements:

- Non-aqueous based decontamination systems for sensitive equipment
- Capable of being used in both mobile and fixed-sites

Description:

Provide a first ever capability to decontaminate chemical and biological warfare agents and toxins from sensitive electronic, avionics, and electro-optic, equipment. It's use must be compatible with and not degrade sensitive materials or equipment. It must be operator safe and offer protection from off-gassing and direct liquid exposure during decontamination.

Sorbent Decontamination System

Rationale:

Army, Marine Corps (Requirement)
Navy, Air Force (Interest)

Key Requirements:

- Effectively decontaminates all CB warfare agents from contaminated surfaces
- Easy-to use and possess no hazard to users
- Non-damaging and non-corrosive to military equipment
- Environmentally safe to store

Description:

The catalytic sorbent decontamination system provides a simple, rapid, and efficient system to decontaminate small and individual issue items of equipment. It is effective in all environments, is less corrosive, and presents a lowered logistics burden through improved shelf life and reduced special handling and storage needs. The system uses a catalytic component that reacts with the chemical agents being sorbed; this eliminates the potential hazard created by the off-gassing of agents from used sorbents.

M21/M22 Modular Decontamination System (MDS)

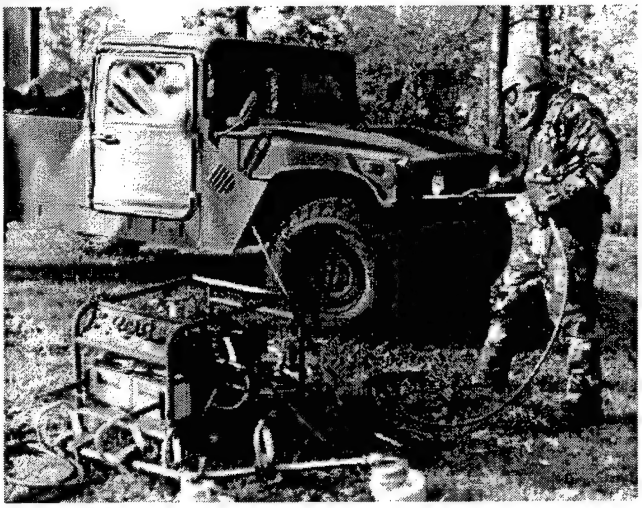
Rationale:

Army (Requirement)
Navy, Air Force Marine Corps (Interest - No Imminent Requirement)

Key Requirements:

- Provide high pressure water for the primary wash process
- Mechanically dispense and scrub decontaminant
- Fit within the payload limits of a 3/4 ton trailer and a 1-1/2 ton trailer
- Use existing equipment to supplement the deliberate decontamination process
- Provide adapters to draw water from fire hydrants

Description:



The MDS will provide the soldier an improved capability to perform detailed equipment decontamination on the battle field. The system will replace current methods of decontamination application (*i.e.*, mops and brooms or with the portable M13 Decontamination Apparatus) which are both time consuming and labor intensive. The MDS reduces water usage, equipment processing time, labor intensiveness and improves effectiveness. The MDS consists of a M21 decontaminant Pumper/Scrubber module, and M22 High Pressure/Hot Water module. The M22 delivers DS2 or liquid field expedient decontaminants and is capable of drawing the decontaminant directly from a container on the ground while mounted on a trailer. The M22 provides hot water up to 3000 psi at a rate of 5 gpm with the capability of high volume cold water and detergent injector. It will also be capable of drawing water from natural and urban water sources and delivering it at variable adjustable pressures, temperatures and flow rates. Each module (M21 or M22) may be transported or operated from a 3/4-ton trailer towed by a M1037 High Mobility Multipurpose Wheeled Vehicle.

M17 Diesel Lightweight Decontamination System (LDS)

Rationale:

Marine Corps (Service-Unique Requirement)
Air Force, Navy (Interest - No Imminent Requirement)

Key Requirements:

- Be capable of operation using Military Standard (MIL STD) fuels
- Have no component which cannot be moved by a four man crew
- Be capable of decontaminating both sides of a vehicle or aircraft simultaneously
- Generate no new manpower requirements

Description:

The Diesel LDS is a portable, lightweight, compact, engine-driven pump and multifuel-fired water heating system. The system will be capable of performing the same hasty and deliberate decontamination procedures as required of the M17 series LDS.

ANNEX D

JOINT MEDICAL CHEMICAL, BIOLOGICAL, AND NUCLEAR DEFENSE RESEARCH PROGRAMS

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JOINT MEDICAL CHEMICAL, BIOLOGICAL, AND NUCLEAR DEFENSE RESEARCH PROGRAMS

The joint medical chemical, biological, and nuclear (radiological) defense research programs are each addressed in the next three sections.

D.1 MEDICAL CHEMICAL DEFENSE RESEARCH & ACQUISITION PROGRAM

D.1.1 Fielded Products

Advances in medical research and development (R&D) significantly improve the warfighting mission by sustaining unit effectiveness through conserving the fighting strength of our forces and supporting the nation's global military strategy, which requires the ability to effectively deploy and operate. Medical R&D products (materiel and non-materiel solutions) provide the foundation that ensures the fielding of a flexible, sustainable, modernized force across the spectrum of conflict and in the full breadth and depth of the battlefield. Overcoming medical threats and extending human performance has provided a significant increase in military effectiveness in the past and presents the potential for future enhancement of military operational effectiveness. Some fielded materiel and non-materiel solutions by medical chemical defense R&D are:

Pharmaceuticals (See Figure D-1):

- Nerve Agent Antidote Kit (Mark I), 1983
- Skin Decontamination Kit (M291), 1990
- Nerve Agent Pretreatment (Pyridostigmine), 1991*
- Convulsant Antidote for Nerve Agent (CANA), 1991*
- Medical Aerosolized Nerve Agent Antidote (MANAA), 1993*

* Initial fielding of these medical products was funded under Low Rate Initial Production (LRIP) options in developmental contracts with RDT&E dollars. Therefore, the following FY96 actions were accomplished: (1) Proved long term extended stability of the medical aerosolized nerve agent antidote (MANAA), the convulsant antidote for nerve agent (CANA), and the nerve agent pretreatment (pyridostigmine), (2) Completed one year follow-up to pyridostigmine gender study, and (3)†submitted new drug application (NDA) for pyridostigmine to the FDA.

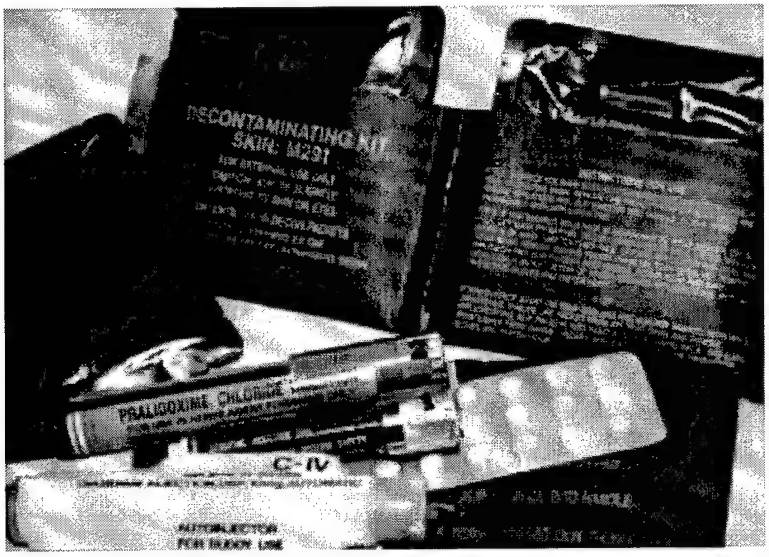


Figure D-1. Field Pharmaceutical Products

Materiel (See Figure D-2):

- Resuscitation Device, Individual, Chemical, 1990
- Decontaminable Patient Litter (NSN 6530-01-380-7309), 1991
- Chemical Warfare (CW) Protective Patient Wrap (NSN 8415-01-311-7711), 1991
- Computer-Based Performance Assessment Battery, 1993
- M40 Protective Mask Vision Correction (optical inserts)

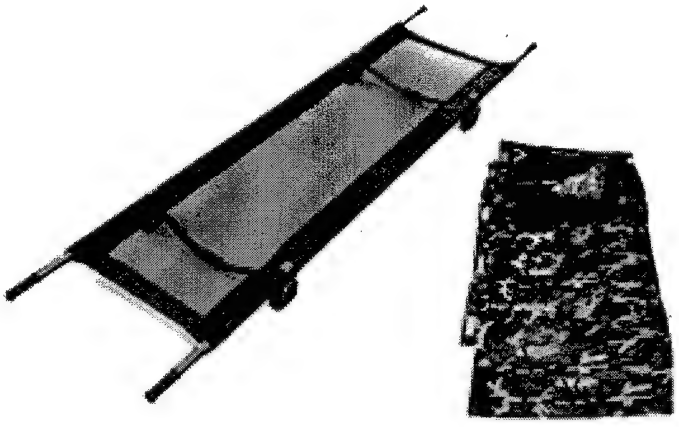


Figure D-2. Decontaminable Patient Litter and CW Patient Wrap

Information and Doctrine:

- Taxonomic Work Station, 1985
- U.S. Army Medical Research Institute of Chemical Defense (USAMRICD) Technical Memoranda on Chemical Casualty Care, 1990

- Field Manual (FM) 8-285, "Treatment of Chemical Agent Casualties and Conventional Military Chemical Injuries," 1990
- Handbook, "Medical Management of Chemical Casualties," 1995
- Field Management Handbook, "Medical Management of Chemical Casualties," 1996
- Technical Bulletin (TB) Medical (MED) 296, 1996
- Compact Disk - Read-Only Memory (CD-ROM) on "Management of Chemical Warfare Injuries," 1996
- Presented instruction on the medical management of chemical casualties (19 courses that trained 1,797 personnel in 1996 including over 600 civilian "first responders"), as shown in Figure D-3.

Figure D-3. Medical Management of Chemical Casualties

D.1.2 Medical Chemical Defense Research and Development Accomplishments

The medical chemical defense research and development technical barriers and accomplishments during FY96 are grouped by the classical chemical threat categories, which include the following:

- Vesicants or blister agents (*e.g.*, sulfur mustard [HD] and Lewisite),
- Nerve agents (*e.g.*, soman [GD], VX),
- Blood agents (*e.g.*, cyanide), and
- Respiratory agents (*e.g.*, phosgene).

The chemical threat, however, is not restricted to commonly accepted classical agents. Novel agents may be developed by potential adversaries. The ability to provide timely and effective medical countermeasures to new threats depends upon maintaining a high level of technological capability.

Countermeasures to these threats include pharmaceuticals, medical equipment, specialized materiel or medical procedures, and concepts for training, doctrine, and organization. Medical countermeasures are designed not only to prevent lethality but to preserve and sustain combat effectiveness in the face of combined threats from chemical and conventional munitions on the integrated battlefield by:

- Prevention of the effects of chemical agents (*e.g.*, pretreatments or prophylaxes),
- Far-forward treatment upon exposure to chemical warfare threats (*e.g.*, antidotes),
- Chemical casualty care (*e.g.*, therapy and management).

THREAT CATEGORY: VESICANT AGENTS

The countermeasures, technical barriers, and accomplishments in the chemical threat category of vesicant agents are outlined below.

Countermeasures:

- Topical protectants to protect skin against blister agents
- Biological/pharmaceutical products to prevent cell death caused by vesicant agents

Technical Barriers:

- Appropriate experimental model systems to predict drug or treatment efficacy and safety in humans
- Pretreatments/antidotes with special characteristics, such as quick action, long-lasting, easy to carry and use
- Reactive/catalytic decontaminant activity versus safety of decontaminant and protectant compounds

Accomplishments:

- Defined and published six medical countermeasure strategies against vesicant agents: intracellular scavengers, cell cycle inhibitors, poly-adenosine diphosphate (ADP) ribose polymerase inhibitors, calcium modulators, protease inhibitors, and anti-inflammatory agents.

- Demonstrated that HD can inhibit a mitochondrial metabolic pathway.
- Demonstrated increased expression of antigens related to a modified differentiation state of keratinocytes following HD exposure.
- Showed that activation of deoxyribonucleic acid (DNA) ligase I in HD exposed keratinocytes involves phosphorylation.
- Determined that fragment crystallizable (Fc) receptor activity, a critical step in generation of an inflammatory reaction, is upregulated in HD exposed keratinocytes.
- Established that oxidation of thiodiglycol is necessary for generation of protein phosphatase inhibition and that this can occur in human skin.
- Developed magnetic biotechnological techniques (electron paramagnetic resonance and nuclear magnetic resonance) for quantitation of reactive species and an enzyme-linked immunosorbent assay (ELISA) for cytokine expression following exposure of cells and tissues to HD.
- Determined that a human organotypic skin model for HD exposure expresses all the ultrastructural components of normal human skin.
- Used human skin biopsies for histochemical and immunohistochemical studies of the pathogenesis of the HD lesion.
- Determined that liquid exposure to HD in the mouse ear model resulted in reproducible edema and subepidermal blister formation.
- Determined that 15 minute cutaneous vapor HD exposure of the weanling pig model reproducibly results in erythema and microblister formation.
- Demonstrated that ethacrynic acid, an inhibitor of glutathione transferase, could elevate intracellular glutathione levels to 200-300% of control levels.
- Demonstrated that calcium chelators and phospholipase A2 inhibitors could block the HD induced release of arachidonic acid from normal human keratinocytes.
- Screened numerous compounds for their ability to prevent HD-initiated loss of adenosine triphosphate (ATP). Four compounds were found to be significantly more effective than niacinamide.
- Identified candidate antiproteases with 100% inhibition of HD-increased protease activity.
- Refined and validated *in vitro* and *in vivo* testing procedures, and developed a database for evaluation of HD injury.
- Began a protocol to study the effects of anti-inflammatory and/or protease inhibitory drugs on increased proteolysis and histopathology associated with HD cutaneous injury.
- Synthesized guanine-nitrogen mustard and guanine-sulfur mustard adducts as internal standards for quantification of vesicant activity and antivesicant efficacy.
- Determined that sulfur and nitrogen mustards stimulate protease activity in human skin cells *in vitro* and in the mouse ear model *in vivo*.
- Demonstrated that mustard-stimulated protease is calcium dependent and is likely a serine protease.
- Developed a rabbit eye model for HD eye injury and then evaluated anti-inflammatory agents, antibiotics and protective contact lenses as post-exposure treatments or as prophylaxes to ocular liquid sulfur mustard exposure.
- Refined technique to evaluate laser debridement of HD burns.

- Determined that laser wound debridement was an effective accelerator of wound healing in skin exposed to sulfur mustard vapor.
- Evaluated temporary wound dressings in conjunction with surgical debridement of skin exposed to sulfur mustard vapor.
- Developed effective methods to detect 2-chlorovinylarsenous acid (CVAA) in the urine of guinea pigs exposed to Lewisite.

THREAT CATEGORY: NERVE AGENTS

The countermeasures, technical barriers, and accomplishments in the chemical threat category of nerve agents are outlined below.

Countermeasures:

- Topical protectants to protect skin against thickened nerve agents
- Pretreatment regimen that protects against incapacitating effects
- Improved antidote to treat incapacitating effects
- Anticonvulsant antidote to prevent or minimize convulsions and brain injury

Technical Barriers:

- Appropriate experimental model systems to predict drug or treatment efficacy and safety in humans
- Pretreatment/antidotes with special characteristics, such as quick action, long-lasting, easy to carry and use
- Central nervous system (CNS) active drugs with acceptable side-effects
- Generation of immune response to small molecules

Accomplishments:

- Determined that potent centrally active anticholinergics are the class of drugs to recommend for Milestone 0 transition as advanced anticonvulsants; identified four leading compounds for further testing.
- Developed a double mutant of human butylcholinesterase (hBuChE) that ages slowly and catalyzes the hydrolysis of soman and other nerve agents to be used as a second generation antidote for nerve agents.
- Submitted portable field blood cholinesterase test system to the Food and Drug Administration (FDA) in FY 96.
- Developed effective methods to detect the specific degradation products of nerve agents (VX and tabun (GA)) in spiked urine samples.
- Initiated new method to facilitate isolation of hBuChE and its mutants from cell culture medium.
- Established and validated 2 novel expression systems for hBuChE to speed production of mutants for testing.

- Conducted research which showed that rhesus monkeys trained under a Serial Probe Recognition (SPR) task showed no behavioral deficits when administered 25,000 units of unpurified BuChE, sufficient enzyme to protect against two median lethal doses of soman.
- Covalently coupled highly purified acetylcholinesterase to a synthetic sponge for development of a nerve agent decontaminating sponge when soaked in an oxime solution.
- Developed cellular expression system for human carboxylesterase (hCaE).
- Altered C-terminal amino acid of hCaE to allow for secretion of the bioscavenger into the medium for ease of production and purification.
- Produced three different antibody fragments (fragment antigen binding (Fabs)) for use in immunoassays.
- Tested five monoclonal antibodies for binding against soman acid analogues. The Fabs are being purified for competitive binding assays against soman acid.
- Identified a monoclonal anti-soman antibody useful for diagnosing, in an ELISA, a sublethal soman exposure.
- Developed model of seizures and brain damage; time-dependent sequential activation of cholinergic and glutamatergic receptors.
- Evaluated anticonvulsant effectiveness of experimental drugs, antiepileptic drugs, and neuroprotectants.
- Determined factors that influence seizure expression with nerve agents (GA, GB, VX).
- Initiated study to determine the utility of using cardiac isoenzymes as biomarkers of cardiac damage following nerve agent-induced seizures.
- Advanced evaluation of anticonvulsant effectiveness of anticholinergics versus diazepam.
- Extended use of cholinesterase-oxime combinations by covalently linking enzyme within polyurethane foam for potential use in skin and wound decontamination.
- Demonstrated that Huperzine-A afforded protection of animals from soman poisoning, reduced neuronal cell death, and reduced soman-induced seizures.

THREAT CATEGORY: BLOOD AGENTS

The countermeasures, technical barriers, and accomplishments in the chemical threat category of blood agents are outlined below.

Countermeasures:

- Pretreatment compounds to protect against rapid action of these chemical agents

Technical Barriers:

- Appropriate experimental model systems to predict drug or treatment efficacy and safety in humans
- Pretreatments/antidotes with special characteristics, such as quick action, long-lasting, easy to carry and use

Accomplishments:

- Synthesized potential metabolites of cyanide antidotes.
- Resolved racemic cyanide antidote into pure optical isomers.
- Concluded animal toxicology studies for cyanide pretreatment.
- Demonstrated extended stability of the cyanide pretreatment product.

THREAT CATEGORY: RESPIRATORY AGENTS

The countermeasures, technical barriers, and accomplishments in the chemical threat category of respiratory agents are outlined below.

Countermeasures:

- Short-term: Health risk criteria for emerging threat doctrine, care and treatment strategies
- Intermediate-term: Specific casualty management techniques to improve survival and minimize lost duty time
- Long-term: Pharmaceutical/biological pretreatments, antidotes, or decontaminants/ protectants

Technical Barriers:

- Appropriate experimental model systems to predict drug or treatment efficacy and safety in humans
- Pretreatment/antidotes with special characteristics, such as quick action, long-lasting, and easy to carry

Accomplishments:

- Developed the miniature swine inhalation model to evaluate common clinical endpoints utilized in human intensive care, including clinical chemistry and hematology, x-rays, pulse oximetry, impedance plethysmography and arterial blood gas analysis.
- Demonstrated significant efficacy of ibuprofen and verapamil as treatment in mice exposed to phosgene.

D.1.3 Advanced Development Products

In advanced development, the goal is proof-of-principle. Efforts in this category are directed toward the solution of identified deficiencies. The medical R&D process links the materiel developer (U.S. Army Medical Research and Materiel Command (USAMRMC)) with the combat and training developer (Army Medical Department Center and School (AMEDDC&S)) and the logistician in addressing the threat and Department of Defense (DoD) requirements. Medical chemical defense products now in the advanced development phase are

the following:

PRODUCT: TOPICAL SKIN PROTECTANT (TSP)

Concept:

- Use perfluorinated formulations.
- Form non-toxic, non-irritating barrier film layer on skin.
- Augments Mission Oriented Protective Posture (MOPP)
- Protection against vesicant and nerve agents

Status:

- Two candidates transitioned to demonstration-validation phase
- Candidates demonstrated efficacy against broad spectrum of threat agents
- Investigational New Drug (IND) application submitted to the FDA
- Demonstrated the human safety and technical performance of the topical skin protectant
- Demonstrated extended stability of the topical skin protectant
- Validated production/manufacturing capability for the topical skin protectant.
- Began research for a safe and efficacious reactive component for a second generation reactive topical skin protectant (rTSP) that will provide equivalent protection against penetration and will detoxify both vesicant and nerve chemical warfare agents. Toward this goal, established a working list of candidate reactive moieties for a rTSP and for wound decontamination systems coupled to a research plan to acquire and evaluate them.

PRODUCT: MULTICHAMBERED AUTOINJECTOR

Concept:

- Speed administration of life-saving antidotes against nerve agents
- Replace 2 Injector Mark I Nerve Agent Antidote Kit with single autoinjector

Status:

- Engineering contract awarded in September 1993
- Fielding will require full FDA approval
- Demonstrated the human safety and technical performance of the multi-chambered autoinjector
- Demonstrated extended stability of the multi-chambered autoinjector

PRODUCT: CYANIDE PRETREATMENT

Concept:

- Provide protection against incapacitation and lethality without performance degradation
- Enhance soldier protection and sustainment

Status:

- Lead component transitioned to advanced development
- Completed pre-clinical toxicology and drug distribution studies
- Developed dose parameters and performance assessments
- Concluded animal toxicology studies for cyanide pretreatment
- Demonstrated extended stability of the cyanide pretreatment product

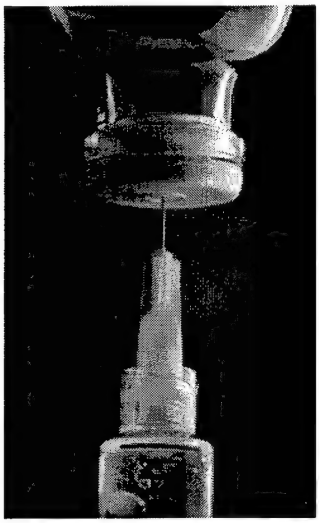
D.2 MEDICAL BIOLOGICAL DEFENSE RESEARCH & ACQUISITION PROGRAM

D.2.1 Biological Defense Products

Advances in DoD medical R&D significantly impact the warfighting mission by sustaining unit effectiveness through conserving the fighting strength of our soldiers and supporting the nation's global military strategy which requires the ability to effectively deploy and operate. Medical R&D products (materiel and non-materiel solutions) provide the foundation that ensures the fielding of a flexible, sustainable, modernized force across the spectrum of conflict and in the full breadth and depth of the battlefield. Overcoming medical threats and extending human performance has provided a significant increase in military effectiveness in the past and presents the potential for future enhancement on military operational effectiveness. Some of the materiel and non-materiel solutions by medical biological defense R&D include the following:

Vaccines:

- Anthrax Vaccine (licensed)
- Botulinum Toxoid Vaccine, Pentavalent (IND #3723)
- Botulinum Type F Toxoid Vaccine (IND #5077)
- Botulism Immune Globulin (F(ab')2), Equine (IND #3703)
- Botulism Immune Globulin, Human (IND #1332)
- Eastern Equine Encephalitis Virus Vaccine (IND #266)
- Q Fever Vaccine, Purified Whole Cell, CM Residue, Formalin Inactivated, Gamma Irradiated (IND #3516)
- Tularemia Vaccine (IND #157)
- Vaccinia Virus Vaccine, Cell Cultured (IND #4984)
- Venezuelan Equine Encephalomyelitis Virus Vaccine, TC-83 (IND #142)
- Western Equine Encephalitis Virus Vaccine (IND #2013)



Information and Doctrine:

- Handbook "Medical Management of Biological Casualties," 1996
- Presented instruction on the medical management of biological casualties (19 courses that trained 1,797 personnel in 1996 including over 600 civilian "first responders")

D.2.2 Biological Defense Research and Development Accomplishments

The biological defense research and development technical barriers and accomplishments during FY96 are grouped by biological threat category, which include the following:

- Bacterial (and rickettsial) agents,
- Protein toxins, and
- Viral agents

In addition, research and development accomplishments in the area of confirmatory assays for biological warfare threat agents is presented at the end. The objective of this effort is to develop the capability to confirm in biological samples the initial field diagnosis of a biological warfare threat agent.

THREAT CATEGORY: BACTERIAL AGENTS

The countermeasures, technical barriers, and accomplishments in the biological threat category of bacterial agents are outlined below.

Countermeasures:

- Vaccines for immunity against threat agents
- Antibiotics for treatment of bacterial diseases
- Forward deployed diagnostic systems

Technical Barriers:

- Incomplete genetic information for all the threat agents
- Appropriate animal model systems for investigation of bacterial threats and countermeasures
- Capability to produce Good Manufacturing Practice (GMP) pilot lots of vaccine candidates
- Inability to perform human clinical trials to prove efficacy of vaccines
- Difficulty in optimizing and comparing different expression vectors for recombinant products
- Immunogenicity of vaccine
- Difficulty in field testing rapid identification kits under natural conditions
- Defining surrogate markers of protection

Accomplishments:

Anthrax

- Demonstrated in the rabbit model of inhalation anthrax that two doses of 5 or 0.5 μg of recombinant anthrax protective antigen (PA) are protective.

- Completed comparison of efficacy of the recombinant PA with the current licensed vaccine in the non-human primate model of inhalation anthrax and demonstrated that two doses of 5 or 0.5 μg of recombinant PA is protective. This protection is comparable to that achieved by the licensed human vaccine.
- Completed comparison of efficacy of recombinant PA combined with different adjuvants in the non-human primate model of inhalation anthrax.
- Developed antitoxin neutralization assays.
- Demonstrated partial passive protection of rabbits from subcutaneous and aerosol challenge with hyperimmune serum.
- Presented research plan to the Joint Program Office for Biological Defense and the FDA in pre-IND meeting concerning a proposed amendment of the anthrax vaccine adsorbed license to reduce the number of required doses and to include an indication for aerosol exposure.
- Approved protocols and qualified a contracting facility for producing a master cell bank of the non-sporulating delta Sterne-1 (pPA102) CR4 anthrax strain for production of recombinant PA.
- Prepared IND to evaluate optimal two doses regimen of licensed human anthrax vaccine in humans.

Plague

- Demonstrated that aminoglycoside alternatives to streptomycin and fluoroquinolones are effective in post-exposure treatment of experimental plague pneumonia while beta-lactam antibiotics are ineffective if given late after exposure.
- Demonstrated efficacy of recombinant Fraction 1 (F1) capsule in protecting against experimental pneumonic plague in rodents.
- Demonstrated efficacy of recombinant V antigen in protecting against experimental pneumonic plague caused by F1-positive or F1-negative strains of *Yersinia pestis*.
- Demonstrated efficacy of recombinant Fraction 1 - "V" antigen (F1-V) fusion protein in protecting against experimental pneumonic plague in rodents caused by F1-positive or F1-negative strains.
- Submitted patent application for use of recombinant F1-V antigen fusion protein as candidate plague vaccine.
- Cloned, expressed, purified, and tested nine additional virulence factors as potential vaccine candidates, showing that only one showed any efficacy against experimental infection.
- Demonstrated that siderophore-mediated iron uptake but not hemin utilization is necessary for virulence of *Yersinia pestis* from a subcutaneous route.
- Developed *in vivo* and *in vitro* models to determine mechanism of action and immunity to V antigen.
- Developed ELISA and Western Blot assays to comprehensively analyze the immune response of rodents to plague infection.

Glanders

- Acquired ten strains of *Burkholderia mallei*, the causative agent of glanders, and

completed *in vitro* growth conditions and biochemical characterization.

- Determined decontamination procedures and irradiation kill curves for *Burkholderia mallei.*
- Evaluated seventeen antibiotics *in vitro* against a single virulent strain.
- Completed initial median lethal dose (LD_{50}) determinations for two strains in hamsters.
- Generated rabbit anti-whole cell sera as initial diagnostic reagents.

Brucellosis

- Developed double deletion mutants of a *Brucella* species.
- Demonstrated efficacy of two vaccine candidates against intranasal challenge in mice.

Typhus

- Characterized human and mouse humoral and cellular immune responses to typhus infection.
- Developed mouse and guinea pig protection models.
- Demonstrated surface protein antigen (SPA) subunit vaccine efficacy in eliciting protection against typhus in mice and guinea pigs.
- Mapped human T-cell epitopes on SPA.
- Chemically characterized SPA and cloned SPA gene.
- Identified phage expression epitopes for toxin neutralizing antibodies against *Rickettsia prowazekii.*
- Partially characterized methylation sites on SPA.
- Studied proteolytic processing of SPA precursor to mature surface antigen used as vaccine.
- Designed primers for cloning and overexpressing segments of SPA.

THREAT CATEGORY: PROTEIN TOXINS

The countermeasures, technical barriers, and accomplishments in the biological threat category of protein toxins are outlined below.

Countermeasures:

- Antibodies (antitoxins) directed against common antigens of protein toxin molecules
- Vaccines for immunity against protein toxin threat agents
- Confirmatory assays to identify protein toxins specifically or classes of protein toxins
- Drugs for supportive therapy of agent intoxication

Technical Barriers:

- Capability to produce GMP pilot lots of vaccine candidates
- Inability to perform human clinical trials to prove efficacy of vaccines and antitoxins
- Difficulty in optimizing and comparing different expression vectors for recombinant products

- Immunogenicity of vaccine and vaccine delivery technology
- Difficulty in field testing diagnostic kits under natural conditions
- Difficult to produce polyvalent vaccines against toxin classes
- Lack of rapid confirmatory assays with "gold standard" sensitivity and specificity
- Appropriate animal model systems for investigation of protein toxin threats and countermeasures
- Defining surrogate markers of protection

Accomplishments:

Botulinum Toxin

- Demonstrated a significant delay in the onset of botulinum toxin-induced muscle paralysis by appropriate combinations of a receptor blocker, zinc chelator, metalloprotease inhibitor and aminoquinoline compound.
- Successfully expressed a synaptobrevin peptide by recombinant DNA techniques in an *Escherichia coli* strain. This peptide was rapidly cleaved by botulinum neurotoxin (BoNT) and is currently used in cell-free assays to test potential BoNT inhibitors.
- Optimized capillary electrophoresis conditions for detection of the synaptobrevin peptide. The parameters optimized included voltage, ionic strength, pH, and reactant concentrations (BoNT/B light chain and substrate)
- Designed three dipeptide phosphoramidate compounds that are complimentary to the BoNT/B cleavage site in synaptobrevin. Preliminary cell-free assays indicate that the phenyl analog is able to reduce the cleavage rate of BoNT/B but the methyl and ethyl analogs are relatively inactive.
- Demonstrated that the clinically used antihypertensive agent, Captopril, can inhibit cleavage of the synaptobrevin peptide. Captopril was only marginally effective in protecting isolated muscles from BoNT/B action, presumably due to its poor penetration of plasma membranes.
- Examined the clinically used antimalarial agent, chloroquine, for its ability to reduce the rate of BoNT/A mediated muscle paralysis in the mouse phrenic nerve hemidiaphragm preparations. Chloroquine produced a 3 fold slowing in the time-to-paralysis when added prior to or simultaneously with BoNT/A.
- Performed structure-activity studies with additional aminoquinoline and acridine compounds. The resulting rank order potencies (in decreasing order) were: quinacrine, amodiaquine, chloroquine, and quinine. Primaquine and WR242511 were ineffective.
- Performed molecular modeling studies to determine the salient features of the BoNT-mediated transmembrane channel responsible for translocation of the light chain into the cytosol. The channel is formed by four regions of the N-terminal half of the heavy chain and has a negatively charged lumen.
- Demonstrated that the effective aminoquinoline compounds can block this channel by providing complimentary groups for hydrogen bonding and electrostatic and hydrophobic interactions with the channel interior. The inactive antimalarial compounds (Primaquine and WR242511) lacked these features and were unable to bind effectively to the BoNT channel lumen.

- Established optimal combinations of potential therapeutic agents for antagonizing the binding, translocation and proteolytic activity of BoNT/A and /B in the phrenic nerve hemidiaphragm preparation.
- Synthesized and inserted in intracellular yeast vector all 7 recombinant botulinum toxin fragment C regions for serotypes A, B, C1, D, E, F and G.
- Completed Master Cell Bank and Master Cell Production Bank for botulinum neurotoxin heavy chain (Hc) at Walter Reed Army Institute of Research (WRAIR) GMP pilot lot facility.
- Initiated development of a potency test for recombinant botulinum toxin vaccines.
- Initiated excipient study to determine optimal cryoprotectants and stabilizers for vaccine formulations.
- Initiated aerosol dose-ranging studies for all 7 botulinum toxin serotypes in non-human primates.
- Initiated simultaneous comparative study of in-house botulinum toxin mouse serum neutralization bioassay and two botulinum toxin ELISAs, to assess correlation between the three assays and to explore possibility of replacing bioassay with ELISA.
- Filed invention disclosure which describes botulinum toxin enzymatic cleavage assay and potential uses for it as a research, diagnostic or detection tool.
- Synthesized 17 peptide substrates for botulinum toxin A, four of which inhibit toxin activity, to be characterized further as toxin antagonists.
- Developed affinity-purified polyclonal antibodies to detect botulinum toxin A, B, and E in clinical and field samples.
- Developed and still characterizing neutralizing monoclonal antibodies against botulinum toxin A, E, and F as research tools.
- Synthesized phosphoramidon-like peptides as botulinum antidotes.
- Developed rapid *in vitro* assay for botulinum B serotype.
- Screened eight compounds for inhibition of botulinum endopeptidase activity.
- Developed production plan for and produced GMP lot of botulinum B seed material.
- Discovered that mastoparan, a releaser of arachidonic acid, protects against botulinum toxin A via increased vesicle fusion in PC12 cells *in vitro*.
- Developed sensitive and specific hand-held assay for botulinum toxins A and B.

Staphylococcal Enterotoxin B (SEB)

- Expressed triple mutant SEB vaccine in bacterial and yeast vectors.
- Expressed triple mutant staphylococcal enterotoxin A (SEA) vaccine in bacterial vector.
- Demonstrated that triple mutant SEB vaccine protects non-human primates from lethal aerosol SEB challenge.
- Fully characterized and reported the lethal aerosol SEB non-human primate model.
- Fully characterized and reported the lipopolysaccharide (LPS)-potentiated lethal aerosol SEB rodent model.
- Developed an incapacitating aerosol SEB rodent model.
- Developed ability to detect SEB in picogram quantities in biosamples using specialized mass spectrometry methods.
- Produced affinity purified polyclonal antibodies to detect SEB in biosamples by ELISA.

- Developed surrogate marker assays (ELISA and lymphocyte proliferation inhibition) to predict protective immunity induced by SEB vaccines.
- Identified free-radical scavenger heteropoly anions, 2 anti-cytokine antibodies, 2 cytokine inhibitory drugs, an SEB peptide fragment, and two other FDA approved drugs as viable therapeutic candidates against SEB exposure.
- Developed capability for GMP production of SEB toxin and proteosomes, and methodology for mass production of two mutant protein vaccine candidates.
- Developed sensitive and specific hand-held assay for staphylococcal enterotoxin B.

Ricin

- Produced and bottled a GMP pilot lot of lyophilized, deglycosylated ricin A-chain (DGA) vaccine candidate and initiated characterization and stability testing of this vaccine pilot lot.
- Developed and designed a potency test for the DGA vaccine candidate.
- Developed and characterized a lethal mouse ricin aerosol model to assess immunogenicity and survivability conferred by ricin vaccines.
- Developed and characterized a lethal rat ricin aerosol model to assess immunogenicity, survivability, and protection from lung injury conferred by ricin vaccines.
- Developed ability to detect ricin in nanogram quantities in biosamples using specialized mass spectrometry methods.
- Compared two in-house, established cell culture ricin serum neutralization tests, to select a test for standardization and validation.

THREAT CATEGORY: VIRAL AGENTS

The countermeasures, technical barriers, and accomplishments in the biological threat category of viral agents are outlined below.

Countermeasures:

- Vaccines for immunity against viral threat agents
- Antibodies and antivirals for treatment of viral disease
- Devices and technologies for diagnosis of viral disease

Technical Barriers:

- Appropriate animal model systems for investigation of viral threats and countermeasures
- Capability to produce GMP pilot lots of vaccine candidates
- Inability to perform human clinical trials to prove efficacy of vaccines
- Production of multivalent vaccines against heterologous viral agents
- Difficulty in optimizing and comparing different expression vectors for recombinant products (vaccines and antibodies)
- Immune enhancement of disease
- Rapid virus identification technology

- Defining surrogate markers of protection

Accomplishments:

Encephalitis Viruses

- Met Milestone 0 pre-clinical technical issues (exit criteria) for a new Venezuelan equine encephalomyelitis (VEE) 1A/B/C vaccine by demonstrating that: the duration of immunity in rodents is greater than one year; the rate of induction of immunity in rodents is one week; there is no neurovirulence in rodents; and there is no reversion to wild type virus in rodents.
- Established methods for production of GMP pilot lot of new VEE vaccine.
- Developed full-length clone of western equine encephalomyelitis (WEE); generated an attenuated WEE vaccine candidate and initiated assessment in rodents.
- Cloned structural genes of eastern equine encephalomyelitis (EEE), and IE and III of VEE and expressed proteins for use as immunogens and diagnostic reagents.

Variola, the Causative Agent of Smallpox

- Identified three drugs as candidates for smallpox therapy.
- Transferred PCR-based diagnostic techniques from the Centers for Disease Control and Prevention (CDC) to the U.S. Army Medical Research Institute of Infectious Diseases (USAMRIID).
- Expressed vaccinia virus proteins for surrogate marker studies.
- Selected and characterized human monoclonal antibodies which neutralize vaccinia virus.
- Developed aerosol model of monkeypox virus in non-human primates.
- Evaluated efficacy of existing smallpox vaccine against aerosol exposure of monkeypox virus in non-human primates.

Filoviruses

- Developed models for filovirus infections in guinea pigs and mice.
- Assessed the value of passive therapy in filovirus infection, including evaluating the Russian equine immunoglobulin product for the World Health Organization.
- Pathogenesis studies identified the mononuclear phagocyte system as a primary target of Ebola utilizing in-situ hybridization and immunohistochemical staining, and suggested cytokines as a critical factor in pathogenesis.
- Cloned genes and expressed the individual proteins of both Marburg and Ebola viruses in several potential vaccine vehicles.
- Performed initial evaluations of potential vaccine strategies in rodent models.

CONFIRMATORY ASSAYS FOR BIOLOGICAL WARFARE THREAT AGENTS

The accomplishments in the confirmatory assays for biological warfare threat agents are outlined below. The objective of this effort is to develop the capability to confirm in biological samples the initial field diagnosis of a biological warfare threat agent.

- Demonstrated ultrasensitive electrochemiluminescence (ECL) detection of 0.01–100 ng *Yersinia pestis* F1 antigen per milliliter of sera.
- Demonstrated probe-based/microplate assay for field detection of amplified polymerase chain reaction (PCR) products.
- Demonstrated the next generation of probe-based amplified nucleic acid detection using technology compatible with real time quantitative PCR.
- Evaluated methods for rapid specimen preparation for nucleic acid detection methods.
- Improved diagnostic reagents for immunological diagnosis of biological warfare threat agents by doing the following: used automated high-pressure liquid immunoaffinity chromatography to efficiently purify diagnostically-relevant antigens; demonstrated the feasibility of using hyperimmunized laying hens as a source for producing immunoaffinity-purified antibodies; successfully transitioned chicken anti-VEE virus antibody for use in the chromatographic immunoassay format; and, produced immunoreagents and provided them to a commercial contractor for the development and delivery of VEE virus detection chromatographic immunoassays.
- Developed diagnostic methods for the identification and characterization of variola viruses by doing the following: sequenced 4 genes of representative orthopoxviruses; identified and evaluated primers for 7 gene targets; demonstrated "taqman" PCR technology for differentiating between closely related orthopoxviruses; demonstrated large fragment PCR amplification of orthopoxviruses; and, demonstrated the utility of RFLP analysis of orthopoxviruses.
- Demonstrated sensitive nucleic acid based detection assay for *Brucella* species.
- Demonstrated sensitive multiplex nucleic acid based detection assay for *Bacillus anthracis* (the causative organism of anthrax).
- Demonstrated sensitive multiplex nucleic acid based detection assay for *Clostridium botulinum* A/B/E/F.

D.2.3 Advanced Development Accomplishments

- Conducted pre-clinical testing of improved anthrax vaccine for Milestone I transition.
- Investigated safety and efficacy of vaccine candidates for brucellosis and plague in animal models.
- Evaluated Venezuelan equine encephalitis infectious clone vaccine candidate in animal models and prepared data package for Milestone I transition.
- Demonstrated efficacy of subunit vaccine candidates for ricin toxin using *in vivo* models and identified potential surrogate markers of protective immunity.
- Conducted pre-clinical testing of the SEB toxoid vaccine candidate and evaluated second generation vaccine candidates against lethal effects from the toxin.
- Evaluated pharmacological prophylaxis and developed recombinant vaccine candidate expression system, and a GMP level product against botulinum toxins.
- Evaluated candidate systems for sensitive and specific confirmatory diagnosis of viral and bacterial biological warfare (BW) agents in clinical samples.

D.2.4 Joint Vaccine Acquisition Program Accomplishments

The development of vaccines under this program involves studies which demonstrate product safety and efficacy and which are required for product licensure by the FDA. The Joint Vaccine Acquisition Program is managed by the Joint Program Office for Biological Defense. During FY96, the following actions were accomplished:

- Initiated data collection and collation from laboratory studies and manufacturing records to support an FDA license amendment for the anthrax vaccine for a reduced immunization schedule (number of doses for protection).
- Initiated data collection and collation from laboratory studies and manufacturing records to support an FDA license application for botulinum pentavalent vaccine.
- Began clinical evaluations of volunteer and laboratory workers to determine the effects of multiple immunizations with biological defense (BD) vaccines under the special immunization program (long term immunization studies).
- Prepared product license application and establishment license application for tularemia vaccine and submitted both to the FDA.
- Completed independent government cost estimate for BD vaccine prime systems contract.
- Released a request for proposal seeking a comprehensive integrated approach to developing, licensing, producing, testing, and storing BD vaccines (Prime Systems Contract).

D.3 MEDICAL NUCLEAR (RADIOLOGICAL) DEFENSE RESEARCH AND ACQUISITION PROGRAM

D.3.1 Fielded Products

Advances in medical R&D significantly impact the warfighting mission by sustaining unit effectiveness through conserving the fighting strength of our service members. The individual service member whose performance is decremented by disease symptoms is significantly more likely to become a traumatic casualty. In this era of small, but highly lethal forces, loss of only a few team members can dramatically diminish a unit's capability. Medical R&D products (materiel and non-materiel solutions) provide the foundation that ensures the fielding of a flexible, sustainable, modernized force across the spectrum of conflict and in the full breadth and depth of the battlefield. Overcoming medical threats and extending human performance has provided a significant increase in military effectiveness in the past and presents the potential for future enhancement on military operational effectiveness. Some of the fielded materiel and non-materiel solutions by medical radiological defense R&D are:

- *Advances in the Treatment of Radiologic Injuries*, a medical research symposium publication, Permagon Press, Elsivier Science, Ltd.
- North Atlantic Treaty Organization (NATO) Handbook AMedP-6, *Medical Aspects of Nuclear, Biological, and Chemical (NBC) Defensive Operations*
- Medical Effects of Nuclear Weapons Course--Training for approximately 760 Medical Department personnel in FY96.
- Advanced treatment modalities for bone marrow injury, such as the cytokines, which were available for the Gulf War
- New generation antiemetics effective for prevention of early debilitating symptoms of moderate radiation injuries (Now being inserted into NATO doctrine)

D.3.2 Nuclear Defense Research and Development Accomplishments

The nuclear (or radiological) defense research and development technical barriers and accomplishments during FY96 are grouped in the following threat categories:

- Prompt radiation from nuclear weapons,
- Protracted low level radiation from fallout and other sources
- Combined effects of radiation and other factors

"*Prompt radiation*" refers to the high level radiation released by a nuclear weapon detonation in the first sixty seconds after the explosion. Significant injury occurs within seconds of exposure. "*Protracted low level radiation*" refers to radiation from nuclear fallout, radiological dissemination devices, and other sources which contaminate an area with radioactive particles. The exposure time required to cause casualties in this environment is much longer than the

instantaneous exposure of prompt radiation. The "*combined effects*" environment significantly augments the casualty rate by amplifying the subclinical effects of traditional trauma, burns, wounds, and infection. Due to the likelihood of an enemy's simultaneous use of nuclear dissemination weapons and chemical/biological agents, combined injury effects now also must include the previously unresearched interactions of low level radiation and chemical-biological weapons.

THREAT CATEGORY: PROMPT RADIATION

The countermeasures, technical barriers, and accomplishments in the threat area of prompt radiation are outlined below.

Countermeasures:

- Advanced medical treatment strategies for radiation injuries
- Drugs designed to increase resistance of soldiers to radiation and protect the soldier against radiation injury without compromising performance
- Drugs designed to prevent the onset of radiation-induced performance decrements such as fatigue, nausea, vomiting
- Assessment of radiation injury by biological dosimetry techniques

Technical Barriers:

- Known drugs that provide some radiation protective effects have serious performance-degrading side effects at drug doses required for operational requirements
- Mechanisms of action of several known treatment and radioprotective drug strategies are not well understood
- Drug delivery system which allows extended bioavailability is not available for radioprotectants

Status:

- Research in collaboration with pharmaceutical companies using large and small animal models is on-going
- Research using cellular systems and rodents has begun to investigate strategies to mitigate against late effects (*e.g.*, cancer) of radiation
- Research using cellular systems and rodents has begun to investigate strategies to mitigate infection in irradiated animals
- Combination of drugs administered at non-toxic levels which provides protection has been identified
- Biological dosimetry techniques based on cytogenetic techniques are being validated and developed for fielding
- Greater emphasis is being provided on molecular and cellular biology strategies to elucidate mechanisms of radiation damage and protection

Accomplishments:

- Devised and tested prophylactic/therapeutic protocols to show efficacy in reducing the duration of neutropenia and thrombocytopenia.
- Demonstrated that lethal consequences of radiation can be averted with the therapeutic use of cytokines.
- Established new generation blocking agents which can reverse endotoxin shock.
- Devised drug combinations that can provide a margin of safety against ionizing radiation lethality without compromising performance.
- Demonstrated dose assessment techniques based on cytogenetic techniques
- Developed molecular and cellular model systems to validate new approaches to enhance resistance to ionizing radiation.
- Devised therapeutic protocols which combine selected immunomodulators and antibiotics and show efficacy in reducing lethality from infection in irradiated animals.

THREAT CATEGORY: PROTRACTED LOW LEVEL RADIATION

The countermeasures, technical barriers, and accomplishments in the threat area of protracted low level radiation from nuclear fallout, radiological explosive devices, *etc.*, are outlined below.

Countermeasures:

- Advanced medical treatment strategies for protracted radiation injuries from both external and internal sources of radioactivity
- Drugs designed to protect personnel from the early and late effects of ionizing radiation without compromising performance
- Improved techniques to detect and remove internal sources of radioactivity
- Improved drug delivery system to provide protection during the entire period of radiation exposure

Technical Barriers:

- Availability of suitable radiation sources to study the effects of chronic exposure at relevant dose levels
- Difficulty in manipulating cellular repair mechanisms
- Toxicity of chelating agents used to remove sources of radioactivity
- Brief periods in which traditional radioprotective drugs are active
- Toxicity of radioprotective drugs used over protracted periods of time
- Lack of sustained drug delivery system for radioprotectants
- Microbial resistance to antibiotics

Status:

- New facility to permit protracted radiation exposure experiments is being planned to model current and future threat scenarios
- New biological models for internal and external cellular and whole-body chronic exposure studies are being developed
- New programs have been instituted for the study of molecular biology approaches to study gene radiation damage and repair mechanisms
- Novel drug delivery systems (*e.g.*, transdermal patches) are being evaluated for efficacy in providing protection in chronic radiation environments

Accomplishments:

- Established contracts to study chronic human exposures with scientists within the former Soviet Union
- Demonstrated that synaptic potentials in central nervous system neurons show anomalous dose-rate dependence
- Confirmed that low-dose-rate neutrons have an increased rate of oncogenic transformation for certain specific cell lines

THREAT CATEGORY: COMBINED EFFECTS.

The countermeasures, technical barriers, and accomplishments in the threat area of combined effects of nuclear radiation and trauma, burns, and infection are outlined below.

Countermeasures:

- Radiotherapeutic agents designed to decrease morbidity and mortality from multi-organ system failure due to the combined effects of radiation, trauma, burns, and infection
- Radioprotective drugs designed to harden the soldier against the effects of radiation, trauma, burns, and infection
- Combined therapeutic agents designed to decrease morbidity and mortality from and to enhance innate immune responses
- Computer models for predicting casualties following combined exposure to low levels of ionizing radiation and BW/CW agent aerosols

Technical Barriers:

- Availability of reliable animal models to predict effects in humans
- Antimicrobial resistance to current antimicrobial therapeutic agents
- Differences sensitivities of biological systems at all levels to neutrons and gamma rays
- Mechanism of action of cell-growth factors is not well understood
- Sensitivity of bone marrow progenitor cells to low doses of ionizing radiation

Status:

- Research in collaboration with pharmaceutical companies using small and large animal models continues
- Evaluations of radioprotective and radiotherapeutic agents on-going in mixed-field irradiated animal models
- New antimicrobial products under evaluation for the treatment of gram-positive and gram-negative bacterial sepsis in irradiated rodents.
- New immunomodulators evaluated for enhancing innate immune responses against infections.
- Molecular biology techniques utilized to understand the effects of radiation, trauma, and combined effects
- Molecular biology techniques utilized to understand the beneficial effects of cell growth factors, immunomodulators, and antimicrobial agents

Accomplishments:

- Demonstrated that selected radioprotective drugs reduce mortality from combined effects in small animal models
- Demonstrated that selected antimicrobial agents promote survival from infection when given orally to mixed-field irradiated small animal models
- Demonstrated that combined modality therapy including topical/systemic antimicrobial agents, immunomodulators, and radioprotective drugs increase survival from combined effects
- Calculated effectiveness of low yield nuclear weapon for neutralization of BW stockpile using Armed Forces Radiobiology Research Institute (AFRRI) radiation-kill curves for [anthrax] spores of *Bacillus anthracis* (Sterne strain) and spores of three other *Bacillus* species
- Demonstrated that sublethal irradiation significantly decreased survival of mice challenged with [anthrax] spores of *B. anthracis* (Sterne strain)
- Developed first generation model for the interaction of radiation with a biological agent

D.3.3 Predevelopment Products

Technical developments in predevelopment products for medical radiological defense include the following:

- Medical Effects of Nuclear Weapons CD-ROM interactive training program for military health care personnel
- Pre-Transition Information Paper: *Radioprotection by a Combination of Iloprost/Misoprostol/3D-MPL/WR-3689*
- Automated biodosimetry capability based on lymphocyte dicentric analysis.

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ANNEX E

JOINT NUCLEAR, CHEMICAL, AND BIOLOGICAL, DEFENSE PROGRAM FUNDING SUMMARY AND STATEMENT REGARDING CHEMICAL AND BIOLOGICAL DEFENSE PROGRAMS INVOLVING HUMAN SUBJECTS

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INTRODUCTION

Section 1511 of Title 50 of the U.S. Code (50 USC 1511) required the Secretary of Defense to submit an annual report to Congress setting forth amounts spent during the preceding year for research, development, test, and evaluation (RDT&E) of all lethal and nonlethal chemical and biological agents, including a full explanation of each expenditure. In addition, the Secretary of Defense was directed to provide a full accounting of all experiments and studies conducted by DoD in the preceding year, whether directly or under contract, which involve the use of human subjects for the testing of chemical or biological agents.

This reporting requirement was repealed by the FY96 National Defense Authorization Act (Public Law 104-201, Section 1061). Because of public and Congressional concerns regarding this information, a funding summary is provided in Section I of this annex. Information on the use of human subjects involving chemical or biological agents is provided in Section II of this Annex.

SECTION I:
JOINT NBC DEFENSE PROGRAM FUNDING SUMMARY

In accordance with 50 USC 1522, *Department of Defense Chemical and Biological Defense Program*, RDT&E for all DoD chemical and biological defense programs (with the exception of those conducted by the Defense Advanced Research Projects Agency, DARPA) are consolidated into six defense-wide program element (PE) funding lines. Detailed funding information previously contained in this annex is provided annually to Congress in the Joint Service Chemical and Biological Defense Program, President's Budget Submit, Descriptive Summaries of Research, Development, Test and Evaluation, and in the Department of Defense Extract found in the Budget of the United States. These budget submissions provide a detailed account of prior year accomplishments and planned activities for the budget request period. Table E-1 provides a summary of appropriated and requested funding from FY96–FY99. FY96 was the first year in which all Service and Defense Agency CB defense programs were consolidated into defense-wide funding lines. Prior to FY96, funding was included in several separate Service and Defense Agency funding lines. Also, during FY96 approximately $30 million was transferred to the CB Defense Program procurement line from Army operations and maintenance accounts for biodefense vaccine acquisition. Much of the growth in the program between FY96 and FY97 resulted from the transfer of funds between existing accounts rather than real growth in the overall CB Defense Program.

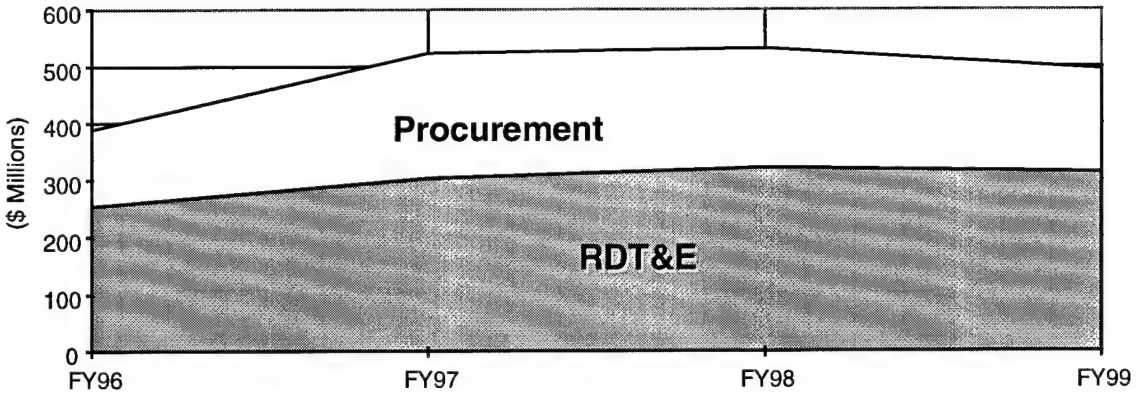

Figure E-1. Chemical and Biological Defense Program Funding

Table E-1. Chemical and Biological Defense Program Funding Summary

	($millions)			
Program Element (PE)	**FY96***	**FY97***	**FY98****	**FY99****
0601384BP - Basic Research	26.528	29.325	25.190	26.018
0602384BP - Applied Research	68.565	67.852	60.023	58.360
0603384BP - Advanced Development	34.219	43.092	41.223	40.581
0603884BP - Demonstration/Validation	29.946	48.492	55.145	61.910
0604884BP - Engineering & Manufacturing Development	87.326	97.476	120.535	108.006
0605884BP - Management Support	7.007	16.365	18.730	17.677
RDT&E Subtotal	**253.491**	**302.602**	**320.846**	**312.552**
Procurement	135.286	220.399	210.010	183.004
CB Defense Program Total	**388.777**	**523.001**	**530.856**	**495.556**

* Appropriation

** President's Budget Request

SECTION II:
STATEMENT REGARDING CHEMICAL AND BIOLOGICAL DEFENSE PROGRAMS INVOLVING HUMAN SUBJECTS

50 USC 1511 previously required the Secretary of Defense to provide "a full accounting of all experiments and studies conducted by the Department of Defense in the preceding year, whether directly or under contract, which involve the use of human subjects for the testing of chemical or biological agents." In addition, 50 USC 1520 requires prior notification of at least 30 days to Congress and others before any such tests are conducted. (See Section III of this annex for the complete text of 50 USC 1511 and 50 USC 1520.)

Table E-2 provides a summary of prior and planned tests conducted by the Department of Defense, both directly or under contract, which involve the use of human subjects for the testing of chemical or biological agents. In summary, there has been no such testing since 1969 with biological agents, since 1975 for chemical agents, and no testing is planned.

Table E-2. Summary of Experiments and Studies with Human Subjects Involving the Use of Chemical or Biological Agents

November 25, 1969	–	Human biological agent testing ended
July 28, 1975	–	Human chemical agent testing ended
Since 1969/1975	–	No activities with human subjects involving exposure to biological agents (since 1969) nor chemical agents (since 1975) have occurred since testing ended

The Department is in full compliance with the requirements of all laws regarding the use of human subjects involving chemical or biological agents. DoD is involved in no experimentation or any other efforts which involve the exposure of human subjects to chemical or biological agents.

As part of the DoD Chemical and Biological Defense Program, DoD requires the use of small quantities of chemical and biological agents in the research, development, test and evaluation (RDT&E) of detection, protection, and decontamination equipment and systems. Chemical agents are also used in small quantities in training U.S. forces to operate in protective equipment and to operate detection and decontamination systems in a chemical or biological environment. However, no RDT&E nor training involves the exposure of human subjects to chemical or biological agents.

Medical chemical and biological defense programs involve the use of human subjects in controlled clinical trials to test and evaluate the safety, immunogenicity, and other effects of medical products (drugs, vaccines, therapies, *etc.*) to protect against chemical and biological agents. The use of human subjects in these trials involves volunteers who have provided informed consent. All use of human subjects in these trials is in full compliance with the

"Common Rule," Federal Policy for the Protection of Human Subjects, Food and Drug Administration (FDA) regulations, Federal Acquisition Regulations (FAR), DoD Directives and Instructions, and *all* other applicable laws, regulations, issuances, and requirements. No medical chemical or biological defense programs involving human subjects involves the exposure of these subjects to chemical or biological agents.

While DoD conducted tests involving the exposure of human subjects to chemical and biological agents in the past, all such tests and programs have been halted and disbanded. The United States formally renounced the "use of lethal biological agents and weapons, and all other methods of biological warfare" in National Security Decision 35, November 25, 1969. Human testing with lethal biological warfare agents was never done and testing with incapacitating biological warfare agents was ceased in 1969. The last human testing of chemical warfare agents occurred on July 25, 1975. Acting Secretary of Army Norman Augustine suspended testing of chemical compounds on human volunteers on July 28, 1975.

Tests involving the exposure of human subjects to chemical agents began in the 1940s and continued following World War II through the Cold War until the early 1970s. Such testing has been documented and reported to Congress. See for example, Department of Army, Inspector General Report, DAIG-IN 21-75, *Use of Volunteers in Chemical Agent Research*, March 1976. In addition, there was extensive Congressional testimony on this subject during 1975 and 1976. DoD has not conducted any experimentation since that time involving the exposure of human subjects to chemical warfare agents.

SECTION III:
TEXT OF PUBLIC LAWS REGARDING USE OF HUMAN SUBJECTS IN TESTS INVOLVING CHEMICAL OR BIOLOGICAL AGENTS

50 USC 1511 Reports to Congress

Repealed by Public. Law 104-106, title X, Sec. 1061(k), Feb. 10, 1996, 110 Stat. 443

The Secretary of Defense shall submit an annual report to Congress on or before January 31 setting forth the amounts spent during the preceding year for research, development, test, and evaluation of all lethal and nonlethal chemical and biological agents. The Secretary shall include in each report a full explanation of each expenditure, including the purpose and the necessity therefor. The report shall include a full accounting of all experiments and studies conducted by the Department of Defense in the preceding year, whether directly or under contract, which involve the use of human subjects for the testing of chemical or biological agents.

50 USC 1520. Use of human subjects for testing of chemical or biological agents by Department of Defense; accounting to Congressional committees with respect to experiments and studies; notification of local civilian officials

(a) Not later than thirty days after final approval within the Department of Defense of plans for any experiment or study to be conducted by the Department of Defense, whether directly or under contract, involving the use of human subjects for the testing of chemical or biological agents, the Secretary of Defense shall supply the Committees on Armed Services of the Senate and House of Representatives with a full accounting of such plans for such experiment or study, and such experiment or study may then be conducted only after the expiration of the thirty-day period beginning on the date such accounting is received by such committees.

(b)(1) The Secretary of Defense may not conduct any test or experiment involving the use of any chemical or biological agent on civilian populations unless local civilian officials in the area in which the test or experiment is to be conducted are notified in advance of such test or experiment, and such test or experiment may then be conducted only after the expiration of the thirty-day period beginning on the date of such notification.

(2) Paragraph (1) shall apply to tests and experiments conducted by Department of Defense personnel and tests and experiments conducted on behalf of the Department of Defense by contractors.

(Pub. L. 95-79, title VIII, Sec. 808, July 30, 1977, 91 Stat. 334; Pub. L. 97-375, title II, Sec. 203(a)(1), Dec. 21, 1982, 96 Stat. 1822.)

ANNEX F

NUCLEAR, BIOLOGICAL, AND CHEMICAL DEFENSE ON THE WORLD WIDE WEB

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Following is a list of selected locations on the World Wide Web (WWW) which provide information about nuclear, biological, and chemical defenses. This list is not intended to be exhaustive, but rather to aid those in the research and analysis of NBC defense issues. Identification of a site here does not represent an endorsement by the Department of Defense nor any of its subordinate organizations, nor any responsibility for the content or accuracy of information provided at each site. Site locations (URLs) may change or be deleted, but were accurate as of March 1, 1997.

CBIAC (Chemical Warfare/Chemical Biological Defense (CW/CBD) Information Analysis Center)

http://www.cbiac.apgea.army.mil/

CBIAC serves as the DoD focal point for CW/CBD technology. The CBIAC serves to collect, review, analyze, synthesize, appraise and summarize information pertaining to CW/CBD. It provides a searchable database for authorized users and links to many other CW/CBD related sites.

The NBC Medical Defense Information Server

http://www.nbc-med.org/

The Nuclear Biological and Chemical Medical (Med-NBC) web page contains extensive medical documentation, training material, audio-video clips, a powerful search engine, and links to other related Internet sites.

The Army Medical Department Center and School

http://www.acs.amedd.army.mil/

Provides extensive information about the Army's Medical Department. Includes information on doctrine development and the use of medical NBC defense products.

U.S. Army Chemical and Biological Defense Command Information Server

http://www.cbdcom.apgea.army.mil/

Home page of the U.S. Army Chemical and Biological Defense Command.

Edgewood Research, Development and Engineering Center (ERDEC) Home Page

http://www.cbdcom.apgea.army.mil/RDA/erdec/

ERDEC is the Army's principal R&D center for chemical and biological defense technology, engineering, and service. Provides technical and other information on ERDEC's products and services.

Dugway Proving Ground Home Page

http://www.atc.army.mil/~dugway/

Home page of the U.S. Dugway Proving Ground, location of much of the field tests of chemical and biological defense equipment and repository of historical chemical and biological warfare information.

Chemical and Biological Weapons Nonproliferation Project

http://www.stimson.org/pub/stimson/cwc/

This project serves as a problem-solver and an information clearinghouse in the general subject areas of CB treaties, chemical demilitarization (especially in Russia), CB terrorism, and related areas. Sponsored by The Stimson Center.

The PTS-OPCW-PrepCom Home Page
http://www.opcw.nl/
The home page of the Provisional Technical Secretariat, the Organization for the Prohibition of Chemical Weapons, and the Preparatory Commission of the Chemical Weapons Convention (CWC). Provides detailed information about the CWC, its implementation, and technical and background information on chemical weapons, chemical defenses, and related subjects.

United States Army Chemical School
http://www.monroe.army.mil/mcclellan/
Home Page for Fort McClellan, Alabama. Provides information on the U.S. Army Chemical School located at Fort McClellan Alabama which is one of the most advanced and sophisticated training centers for chemical and biological defense. Also provides information on the Chemical Corps Museum.

Weapons Systems, United States Army
http://www.dtic.dla.mil/defenselink/pubs/armyfact/
Provides links to information on Nuclear, Biological, and Chemical (NBC) Detection, NBC Reconnaissance System-fox, and Protective Masks (M40 Series).

Harvard Sussex Program on CBW Armament and Arms Limitation
http://fas-www.harvard.edu/~hsp/
Provides files that promote the global elimination of chemical and biological weapons and to strengthen the constraints against hostile uses of biomedical technologies.

Medical Chemical Defense
http://mrmc-www.army.mil/chemdef.html
Provides information on Medical Chemical Defense Overview, Nerve, Agents, Cyanide, Skin Decontamination and Protection, Performance Effects of Protectant Drugs, and Chemical Casualty Management. Linked to the Medical Research and Materiel Command Home Page and the U.S. Army Medical Research Institute for Chemical Defense.

Medical Biological Defense
http://mrmc-www.army.mil/biodef.html
Provides information on Medical Biological Defense Overview, Diagnostic Assays, Viruses, Bacteria, and Toxins, Drugs, Vaccines, and Biological Casualty Management. Linked to the Medical Research and Materiel Command Home Page.

Medical Radiological Defense
http://www.afrri.usuhs.mil/
Provides information on Medical Radiobiological research and education activities of the triservice Armed Forces Radiobiological Research Institute. The site includes information on the latest developments, products, resources, research approach, strategy, research teams/staff, outreach training, professional meetings, and links to related sites.

Defense Special Weapons Agency
http://www.dna.mil/
Provides information on DSWA's Mission, Director, Programs, Procurement Opportunities, and the Defense Nuclear Weapons School.

Program Manager for Chemical Demilitarization

http://www-pmcd.apgea.army.mil/

Provides information on the Chemical Stockpile Disposal Program, the Non-Stockpile Chemical Materiel Program, the Alternative Technologies Program, the Chemical Stockpile Emergency Preparedness Program, and the Cooperative Threat Reduction Office.

ACDA Home Page

http://www.acda.gov/

Home page of the Arms Control and Disarmament Agency. Provides information on nuclear, biological, and chemical weapons and how their delivery systems pose a major threat to our security and that of our allies.

Cal Poly CBW Page

http://www.calpoly.edu/~drjones/chemwarf.html

This page was developed by the students in Chem 450 at Cal Poly, SLO, during Spring, 1996. The goal is to provide an overview of chemical and biological warfare, weapons, and efforts to outlaw them. This site provides a comprehensive overview of numerous aspects of chemical and biological warfare and defenses.

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ANNEX G

ACRONYMS AND ABBREVIATIONS

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–A–

AARS - Advanced Airborne Radiac System
ACADA - Automatic Chemical Agent Detector
ACPG - Advanced Chemical Protective Garment
ACPLA - agent containing particle per liter of air
ACPM - Aircrew Protective Mask
ACT - Arms Control Technology
ACTD - Advanced Concept Technology Demonstration
ADBO - Advanced Battle Dress Overgarment
ADCPE - Advance Deployable Collective Protective Equipment
ADP - Adenosine Diphosphate
ADS - Area Detection System
AERP - Aircrew Eye/Respiratory Protection
AFRRI - Armed Forces Radiobiology Research Institute
AICPS - Advanced Integrated Collective Protective System
AIDECONS - Aircraft Interior Decontamination System
AIDET - Aircraft Interior Detector
AMAD - Automatic Mustard Agent Detector
AMC - U.S. Army Materiel Command
AMEDDC&S - Army Medical Department Center and School
AN/VDR-13 - Compact, digital whole body radiation meter
AN/VDR-2 - Portable dose-rate gamma/beta radiation meter
ANBACIS - Automatic Nuclear, Biological, and Chemical Information System
ARS - Acoustic Resonance Spectroscopy
ASBREM - Armed Services Biomedical Research Evaluation and Management
ASD(HA) - Assistant Secretary of Defense for Health Affairs
ATD - Advanced Technology Demonstration
ATP - Adenosine Triphosphate
ATSD(AE) - Assistant to the Secretary of Defense (Atomic Energy), renamed ATSD(NCB)
ATSD(NCB) - Assistant to the Secretary of Defense for Nuclear and Chemical and Biological Defense Programs, formerly ATSD(AE)
AUIB - Aircrew Uniformed Integrated Battlefield protective garment
AVAD - Automatic Vapor Agent Detector

–B–

B. anthracis - *Bacillus anthracis*
BADS - Biological Agent Detection System
BD - biological detector (also, biological defense)
BDA - Bilateral Destruction Agreement
BDWS - Biological Detector and Warning System
BES - Budget Estimate Submission
BIDS - Biological Integrated Detection System
BMDO - Ballistic Missile Defense Organization
BOG - Board of Governors
BoNT - Botulinum Neurotoxin
BoNT/A - Botulinum Neurotoxin A
BoNT/B - Botulinum Neurotoxin B
BRAC - Base Realignment and Closure
BW - Biological Warfare

–C–

CAM - Chemical Agent Monitor
CAMIN - Chemical Agent Management Information Network
CANA - Convulsant Antidote, Nerve Agent autoinjector
CANE - Combined Arms in a Nuclear/Chemical Environment
CARDS- Chemical Agent Remote Detection System
CAWM - Chemical Agent Water Monitor
CB - chemical and biological (also C/B)
CBASK - Chemical Biological Agent Sample Kit
CBAWM - CB Agent Water Monitor
CBD - chemical and biological defense
CBDCOM - Chemical Biological Defense Command (U.S. Army)
CBMS - CB mass spectrometer
CBPS- CB Protective Shelter
CBR - chemical, biological, and radiological
CBR - chemical, biological, radiological
CBSD - CB Stand-off Detector
CBSD - Chemical Biological Stand-off Detector
CBW - chemical and biological warfare
CDE - Chemical Defense Equipment
CDEPAT - Chemical Defense Equipment Process Action Team
CD-ROM - Compact Disk - Read Only Memory
CDC - Centers for Disease Control and Prevention
CDTF - Chemical Defense Training Facility (at the U.S. Army Chemical School)
CFY - Current fiscal year
CHATH - Chemically/Biologically Hardened Air Transportable Hospital
CIP - CANE Implementation Plan
CM - Chloroform-Methanol
CMAD - Chemical Miniature Agent Detector
CMR - Chloroform-Methanol Residue
CNS - Central Nervous System
CP - chemical protective (also, counterproliferation) (also, collective protection)

CPE - Collective Protection Equipment
CPS - Collective Protection System
CPU - Chemical Protective Undergarment
CTR - Cooperative Threat Reduction
CVAA - Chlorovinylarsenous Acid
CW - Chemical Warfare
CWC - Chemical Weapons Convention
CWCIMS - Chemical Weapons Convention Information Management System
CWCIWG - Chemical Weapons Convention Implementation Working Group
CWDD - Chemical Warfare Directional Detector (AN/KAS-1A)
CWDSO - Chemical Weapons Destruction Support Office
CWICS - Chemical Weapons Interior Compartment System

–D–

DAB - Defense Acquisition Board
DAP - Decontaminating Apparatus Portable
DARPA - Defense Adanced Research Projects Agency
DATSD (CBM) - Deputy Assistant to the Secretary of Defense for Chemical and Biological Matters
DBOF - Defense Business Operations Fund
DCSOPS - U.S. Army Deputy Chief of Staff for Operations
DDR&E - Director, Defense Research and Engineering
DEPMEDS - CB Protected Deployable Medical Systems
DERP - Disposable Eye Respiratory Protection
DGA - Deglycosylated Ricin A-Chain
DISC/DIAL - Differential Scattering/Differential Absorption of Light
DIW - Detection, Identification and Warning
DLA - Defense Logistics Agency
DMARC - Defense Medical Acquisition Review Committee
DMROC - Defense Medical Requirements Oversight Committee
DNA - Deoxyribonucleic Acid (See also DSWA)
DoD - Department of Defense
DPG - Defense Planning Guidance; Also Dugway Proving Grounds
DPSC - Defense Personnel Support Center
DS2 - Decontamination Solution 2
DSWA - Defense Special Weapons Agency (formerly Defense Nuclear Ageny)
DTIRP - Defense Technical Inspection Readiness Program
DTO - Defense Technology Objective

–E–

E. coli - Escherichia coli
ECL - Electrochemiluminescence
EEE - Eastern Equine Encephalomyelitis
ELISA - Enzyme-Linked Immunosorbent Assay
EOD - Explosive Ordnance Disposal
ERDEC - Edgewood Research, Development, and Engineering Center (U.S. Army)

–F–

F1 - Fraction 1
F1-V - Fraction 1 - "V" Antigen
Fab - Fragment Antigen Binding
Fc - Fragment Crystallizable
FDA - Food and Drug Administration
FFEN - CB Protective Firefighter Ensemble
FIS-C - Firefighter Suit -Combat
FM - Field Manual
FSU - Former Soviet Union
FUE - First Unit Equipped
FY - fiscal year
FY96 - Fiscal Year 1996

–G–

GA - tabun, a nerve agent
GB - sarin , a nerve agent
GC - Gas Chromatograph
GCE - Ground Crew Ensemble
GD - soman, a nerve agent
GMP - Good Manufacturing Practice

–H–

HAZWARN - NBC Hazardous Warning System
hBuChE - Human Butrylcholinesterase
Hc - Heavy Chain
hCaE - Human Carboxylesterase
HD - sulfur mustard, a blister agent

–I–

IBAD - Interim Biological Agent Detector
IBMC - Industrial Base Maintenance Contract
ICAM - Improved Chemical Agent Detector
ICDS - Improved Chemical Detection System
IDLH - Immediate Danger to Life and Health
IL CBDWS - In-Line Chemical Biological Defense Water System
IMS - Ion Mobility Spectroscopy
IND - Investigational New Drug
IPDS - Improved (chemical) Point Detection System
IPE - Individual Protective Equipment
ISD - Individual Soldier Detector

ITAP - Improved Toxicological Agent Protective suit
IVD - Individual Vapor Detector

–J–

JBPDS - Joint Biological Point Detection System
JBREWS - Joint Biological Remote Early Warning System
JBUD - Joint Biological Universal Detector
JCHEMRATES - Joint Chemical defense equipment consumption Rates
JCS - Joint Chiefs of Staff
JDDAP - Joint Doctrine Development Action Plan
JFIRE - Joint CB Protective Firefighter Suit
JPCBD - Joint Panel for Chemical and Biological Defense
JPO-BD - Joint Program Office for Biological Defense
JSA - Joint Service Agreement
JSCC - Joint Service Coordination Committee
JSCMAD - Joint Service Chemical Miniature Agent Detector
JSCWILD - Joint Service Chemical Warning and Identification LIDAR Detector
JSIG - Joint Service Integration Group
JSLIST - Joint Service Lightweight Integrated Technology (individual protection)
JSMG - Joint Service Materiel Group
JTCG - Joint Technology Coordinating Group
JTSG - Joint Training Steering Group
JWARN - Joint Warning and Reporting Network

–L–

L - lewisite, a vesicant agent
LAM - Louisiana Maneuvers
LCBPG - Lightweight CB Protective Garment
LD_{50} - Median Lethal Dose
LDS - Lightweight Decontamination System
LIDAR - LIght Detection And Ranging
LPS - Lipopolysaccharide
LRBSDS - Long-Range Biological Stand-off Detection System
LRIP - Low Rate Initial Production
LSCAD - Lightweight Stand-off Chemical Agent Detector
LSCD - Laser Stand-off Chemical Detector
LWRS - Lightweight Reconnaissance System

–M–

MAITS - Mobility Automated Inventory Tracking System
MANAA - Medical Aerosolized Nerve Agent Antidote
MBDRP - Medical Biological Defense Research Program
MCDRP - Medical Chemical Defense Research Program
MCBDRP - Medical Chemical and Biological Defense Research Program
MCU-2A/P - a chemical protective mask
MDS - Modular Decontamination System
MED - Medical
MFR - Multi-Function Radiac Set
MFVS - Mask Fit Validation System
MICAD - Multipurpose Integrated Chemical Agent Detector
MNDRP - Medical Nuclear Defense Research Program
MNS - Mission Needs Statement
MOPP - Mission Oriented Protective Posture
MOS - Military Occupational Specialist
MRC - Major Regional Conflict
MS - Mass Spectrometer
MULO - Multi-purpose Overboot

–N–

NAAK - Nerve Agent Antidote Kit
NAAS - Nerve Agent Antidote System
NAEDS - Non-Aqueous Equipment Decontamination System
NATO - North Atlantic Treaty Organization
NBC - Nuclear, Biological, and Chemical
NBCRS - NBC Reconnaissance System (Fox Vehicle)
NCO - Non-Commisioned Officer
NDA - New Drug Application
NDE - Non-Destructive Evaluation
NDI - Non-Developmental Item
NICP - National Inventory Control Points
NIEX - No-Notice Interoperability Exercise
NRDEC - Natick Research, Development, and Engineering Center (U.S. Army)
NSN - National Stock Number

–O–

OMA - Operations & Maintenance, Army
OPA - Other Procurement, Army
OPCW - Organization for the Prohibition of Chemical Weapons (in The Hague)
ORD - Operational Requirements Document
OSD - Office of the Secretary of Defense
OSIA - On-Site Inspection Agency

–P–

P3I - Pre-Planned Program Improvement
PA - Protective Antigen
PAC - physiologically active compound

PATS - Protective Assessment Test System
PB - President's Budget
PBT - pyridostigmine bromide tablets
PCR - polymerase chain reaction
PDDA - Power Driven Decontamination Apparatus
PDRR - Program Development and Risk Reduction
PF - Positive Force Exercise
PICS - Personal Ice Cooling System
PINS - Portable Isotopic Neutron Spectroscopy
PL 130-160 - Public Law 103-160, The National Defense Authorization Act of FY94
POM - Program Objectives Memorandum
PR - Positive Response Exercise
PY - prior year

–Q–

QRR - Qualitative Research Requirements

–R–

R&D - Research and Development
RAD - Radiological
RAM - Reliability, availability, and maintainability
RDA - Research, Development, and Acquisition
RDTE (Also, RDT&E) - Research, Development, Test and Evaluation
RESPO21 - 21st Century Respiratory Protection System
RF - Russian Federation
RSCAAL - Remote Sensing Chemical Agent Alarm
rTSP - Reactive Topical Skin Protectant

–S–

S&T - Science and Technology
SACPS - Selected Area Collective Protection System
SALAD - Shipboard Automatic Liquid Agent Detector
Saratoga - a CB protective overgarment
SARDA - Assistant Secretary of the Army for Research, Development, and Acquisition
SAW - Surface Acoustic Wave
SBDS - Strategic Bio-Detection System
SBSS - Standard Base Supply System
SCALP - Suit Contamination Avoidance Liquid Protection
SCAMP - Shipboard Chemical Agent Monitor Portable
SD - Stand-off Detector
SD/ASM - Stand-off Detector for Armor System Modernization
SEA - Staphylococcal Enterotoxin A
SEB - Staphylococcal Enterotoxin B
SFAI - Swept Frequency Acoustic Interferometry
SICPS - Standardized Integrated Command Post System and Tent
SOF - Special Operations Forces
SOFCAS - Special Operation Forces Chemical Agent Detector
SORTS - Joint Status of Resources and Training System
SPA - Surface Protein Antigen
SPR - Serial Probe Recognition
STB - Supertropical Bleach
STEPO-I - Interim Self-Contained Toxic Environment Protective Outfit

–T–

TAV - Total Asset Visibility
TB - Technical Bulletin
TRADOC - U.S. Army Training and Doctrine Command
TSP - Topical Skin Protectant
TWA - Time Weighted Average

–U–

USAMMA - U.S. Army Medical Materiel Agency
USANCA - United States Army Nuclear and Chemical Agency
USAMRICD - U.S. Army Medical Research Institute of Chemical Defense
USAMRIID - U.S. Army Medical Research Institute of Infectious Diseases
USAMRMC - U.S. Army Medical Research and Materiel Command
USD(A&T) - Undersecretary of Defense (Acquisition and Technology)
USMC - United States Marines Corps
USUHS - Uniformed Services University of the Health Sciences

–V–

VCA - Voice Communication Adapter
VEE - Venezuelan equine encephalomyelitis
VPFRU - Vapor Protective Flame Resistant Undergarment
VX - a nerve agent

–W–

WEE - Western Equine Encephalomyelitis
WMD - weapons of mass destruction
WRAIR - Walter Reed Army Institute of Research
WRSI - War Reserves Secondary Items